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THE JOHNS HOPKINS UNIVERSITY
STUDIES IN EDUCATION

No. 5

EDITED BY
EDWARD F. BUCHNER

A MEASURING SCALE FOR FREE-HAND DRAWING

PART I.—REPRESENTATION

BY
LINUS WARD KLINE
AND
GERTRUDE L. CAREY

THE JOHNS HOPKINS UNIVERSITY STUDIES IN EDUCATION

EDITED BY EDWARD F. BUCHNER

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A MEASURING SCALE FOR FREE-HAND DRAWING
PART I.—REPRESENTATION

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I. INTRODUCTION: COLLECTING MATERIAL

The scale is intended to measure three general phases of free-hand drawing: Representation, Design and Composition and Color. The themes of each phase from which sample drawings were made were chosen with a view of exemplifying the primary principles of drawing. In using the scale, the attention of both teacher and pupil is directed to the elements of drawing as revealed by the samples in steps of achievement on the scale, and to the more or less analytic descriptions given under each sample. Obviously, then, the scale is essentially analytic in both construction and function. The purpose is to measure drawing as done in public elementary and high schools, to measure the pupils' progress in that subject year by year or grade by grade. The numerical values of the scale units represent values above a sample rated as zero. The relation of grade achievement to these values will be determined as the scale is standardized.

1. From Primary, Grammar and High School Grades

As a rule, the use to which the sample drawings were to be put was explained to the supervisor of drawing in a personal interview. Circular letters describing the purpose of the work, listing the themes for the drawings, and giving details of the conditions under which they were to be prepared were given to the supervisor who distributed them among teachers of drawing. These letters were of three slightly different sorts, depending on whether they were to be used by teachers of lower school grades (first, second, third, and fourth) or by teachers of higher elementary grades (fifth, sixth, seventh and eighth), or by high school teachers. They were sent out in October and November, 1919, under the auspices of the Department of Education of

The Johns Hopkins University. Sample copies of the letters are here given.

To Teachers of Drawing in the Lower Elementary School Grades:

The drawings asked for below are to be used in the construction of a measuring scale for estimating the pupil's rate of progress in drawing.

Three phases of drawing are to be done: 'Representation,' 'Design and Composition,' and 'Color.' The themes from which the drawings are to be made are numbered; four in 'Representation,' four in 'Design and Composition' and four in 'Color.'

Part I. Representation

1. Draw a house. 2. Draw a rabbit. 3. Draw a figure in action (boy running). 4. Make a brush drawing of a tree.

Part II. Design and Composition

1. Illustrate a story. Any story which the teacher may select such as The Pied Piper blowing his horn with children or rats following, The Three Bears, Cinderella, one of Aesop's fables, Aladdin and the Wonderful Lamp, etc., will be acceptable for this exercise. It may be done with colored crayons or scissors and paper.

2. Make a border approximately 2″ x 6″. A tree, a rabbit or other animal, a boat or a house are suggested as units, but any form with which the children are very familiar may be used. It may be done with paper and scissors or with crayons. In the kindergarten and Grade I it may be connected units secured through manner of folding the paper, such as paper dolls taking hold of hands, boats, trees, etc.

3. Make a poster advertising a school activity. In the kindergarten and Grade I, if children are unable to form words, they may make the poster omitting the lettering. The work will and should be crude but it should represent the child's expression of some event within his experience. It may be the announcement of a game, entertainment, or other school activity, a garden poster, or a poster to stimulate thrift, but should, above all, have the child's interest.

4. Draw or cut out of paper a pattern for a bowl or other utensil which you would like to model out of clay. Draw upon it a simple decoration which you think will make it more attractive. This is not to be a drawing in perspective. Make top and bottom lines straight.

Part III. Color

1. Draw from memory the United States flag on 9″ x 12″ drawing paper. Use colored crayons and make the colors as near like the real flag as possible.

2. Paint a flower in color. Use brush and water colors if you have them. If not, draw the flower with colored crayons. This is to be done from memory. (Choose a flower having a decided color—a single flower preferred.)

3. Make a color circle or wheel showing the six standard colors and write the first letter of each color above the circle.

4. Make a border approximately 2″ x 6″ using complementary colors. If available, use colored papers. If not, use colored crayons.

Note.—Kindergarten teachers may do the first two only.

Please have all pupils make from memory one drawing each of Numbers 1, 2, 3 and 4, in each of the three phases indicated above.

Have the pupil write on the back of the drawing paper his age and number of the school grade, but nothing more. No writing of any kind should appear on the page with the drawing. The teacher in charge will record on the back of the drawing the approximate time in minutes required to make it.

As far as possible, have the drawings made under class room conditions.

It is assumed that the drawing paper and other materials will be uniform in quality for all the pupils.

The pupil should understand clearly *what* is to be drawn, but no instruction should be given as to *how* it should be done.

(It is understood that pupils of the kindergarten and of the first grade will attempt only those themes which they understand and of which they have memories, e. g., a house, a boy running, etc.)

To Teachers of Drawing in the Higher Elementary School Grades:

The drawings asked for below are to be used in the construction of a measuring scale for estimating the pupil's rate of progress in drawing.

Three phases of drawing are to be done: 'Representation,' 'Design and Composition' and 'Color.' The themes from which the drawings are to be made are numbered; four in 'Representation,' four in 'Design and Composition' and four in 'Color.'

Part I. Representation

1. Draw a house. 2. Draw a rabbit. 3. Draw a figure in action (boy running). 4. Make a brush drawing of a tree.

Part II. Design and Composition

1. Illustrate a story in such a way as to show the use of the principle of subordination. Any well-known story from literature or history may be chosen. Such subjects as "The Pied Piper of Hamelin," "Hannibal Crossing the Alps," "Jason and the Golden Fleece," "Story of the Wooden Horse," "The Boston Tea Party," "The Courtship of Miles Standish," etc., furnish material from the other subjects in the curriculum.

2. Make a 2″ x 6″ border, illustrating the principles of repetition and rhythm, using any unit with which the children are familiar.

3. Make a poster advertising a school activity, composed of lettering and an illustration. Choose something simple which they know how to draw well, and combine it with as little lettering as possible to make it forceful.

(The above problems may be done with colored crayons, with scissors and paper, with drawing pencils, or with charcoal, but the drawings will be judged on the merits of Design and Composition only.)

4. Draw or cut out of paper a pattern for a bowl, vase, or other utensil which might be modelled out of clay. Draw upon it a simple decoration which will make it more attractive.

(This is not to be a drawing in perspective. Make lines representing the top and the bottom of the dish horizontal.)

(Use paper 9″ x 12″.)

To insure that all pupils work under uniform conditions, it is advised that the following principles of composition be explained to the class before beginning the exercise:

1. Subordination means the organization of elements about a center of interest and the elimination of unimportant details. The use of this principle brings order out of confusion, and gives unity to a design or composition.

2. Repetition in a design or composition means the use of the same element or elements again and again. The intervals may be equal, as in a repeating pattern or border, or unequal, as in a landscape.

3. When the spacing is done in an interesting way it produces rhythm.

Part III. Color

1. Make a color wheel showing twelve colors, including the six standard colors and six intermediate colors. Use water colors if possible. If not, available, use colored crayons. (These colors can be only approximately correct, but the exercise will test the pupil's ability to discriminate in the use of color.)

2. Make a poster using a color triad with black, or white, or both. Use colored papers, water colors, or crayons.

3. Make a decorative landscape, using three values of one hue and a complementary hue.

4. Make a border approximately 2″ x 6″, using two values of one color and its complement. The background will represent one of the values or one color, as desired. Use colored papers, crayons, or water colors.

To Teachers of Drawing in the High School (Grades 9, 10, 11 and 12):

(The instructions here are similar to those given above.)

The material for the several exercises follows:

Part I. Representation

1. Draw a house. 2. Draw a rabbit. 3. Draw a figure in action (boy running). 4. Make a brush drawing of a tree.

Part II. Design and Composition

1. Illustrate a story in such a way as to show the principle of subordination. Any well-known story from literature or history may be chosen. Use pencil, charcoal, or any medium desired, but the drawings will be rated upon the composition only.

2. Make a 2″ x 6″ border illustrating the principles of repetition and rhythm. Any medium may be used, but proportion or good spacing will determine the success of the exercise.

3. Make a poster advertising a school activity. It may be done in any medium, but the exercise will be judged on composition and design only. Technique of drawing or color will not enter into the rating of these posters. Use as little lettering as possible, and for the illustration choose something you can draw well.

4. Make a design for a sideboard showing front and end views. Proportion and spacing will be considered in judging this exercise. This is not an exercise in perspective. Do not try to show the top.

The above problems may be done with colored crayons, or scissors and paper, or with drawing pencils, but the drawing will be judged on the merits of design and composition only. Before beginning the

exercises, be sure that you understand the meaning of the principles involved. The following definitions will assist in this. They may be elaborated upon by the teacher in any way she may desire.

(Definitions of subordination, repetition and rhythm were included as above.)

PART III. COLOR

1. Make a poster using a color triad with gray, black, or white. The poster may be made of colored papers or show card colors.
2. Make a decorative landscape using three values of one hue and a complementary hue.
3. Make a 2″ x 6″ border showing an analogous harmony.
4. Make two scales, one showing six values of one color, and the other six intensities of the same color.

It will be observed that the circular letters required: (1) that the drawings be made under class room conditions as nearly as possible; (2) that they be made from memory and without instruction on the themes immediately preceding or during the drawing exercise; (3) that the time spent in making the drawings (passing and collecting material not included), the age and grade of the pupil, be stated on the back of the drawing. The teacher of art, as well as the general reader, is again reminded that the drawings were done from memory and without coaching for the particular exercise in question.

2. MATERIAL COLLECTED AND CATALOGUED

The first returns were received in December, 1919, from the city public schools of Baltimore. From that date until June, 1920, drawings were received from the city public schools of Washington, D. C., Duluth, Minn., Virginia, Minn. and from Oshkosh, Wis. Over 600 came from two private schools in Baltimore. The number of drawings on the 19 themes in this preliminary collection totalled over 14,000. We are concerned in this report, Part I, with the drawings of the first four themes, drawings that involve the technique of representation only. The number by grades and by themes are shown in Table I. While this number is perhaps sufficient, our experience is to the effect that both quality and variety of the samples would have been more satisfactory had they been gathered from a larger number of localities.

This defect, if it be one, will be corrected in collecting further samples for the remainder of the scale on (1) *design and composition* and (2) *color.*

TABLE I

SHOWING DISTRIBUTION OF DRAWINGS BY GRADES AND BY THEMES

Themes	Grades													
	Kdgn	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Totals
1. House	90	200	204	130	151	136	111	128	90	130	84	33		1487
2. Rabbit	71	137	171	113	88	66	73	109	56	90	22	20	6	1022
3. Figure in action	10	131	179	109	69	120	112	100	66	55	45	36		1032
4. Brush drawing of tree	66	173	286	175	175	178	175	180	122	51	44	48		1673
Totals	237	641	840	527	483	500	471	517	334	326	195	137	6	=5214

In the matter of constructing a scale by using a series of drawings of the same theme, Professor Thorndike says in his pioneer drawing scale that

> If we had in the scale a series of drawings of flowers of merit, 2.4, 3.9, 5.7, 6.5, 7.8, 8.6, 10.5, etc., a series of drawings of horses of merit, 2.4, 3.9, 5.7, 6.5, 7.8, 8.6, 10.5, etc., a series of designs for book-covers of merit, 2.4, 3.9, 5.7, 6.5, 7.8, 8.5, 10.5, etc., ... the scale would obviously be more useful to measure the merit of drawings of horses, book-covers, and flowers . . . . than it now is.

Teachers of drawing will readily understand the reasons for selecting these four themes: house, rabbit, figure in action, brush drawing of tree, for a scale in 'representation,' but that their purpose may be apparent to everyone some further comment is necessary.

Drawing merely to represent objects is not regarded as an end in itself; it is intended, rather, to accompany the work in design and composition and color. The use and treatment of a theme in representation in the teaching of art, then, depends upon the frequency and readiness with which it serves the ends of design and composition. The four themes in question were chosen largely upon that principle and are intended to be thus used by teachers of drawing. They afford suitable exercises for the acquisition of the more elementary forms of technique and for drill work that is so essential in acquiring a drawing "vocabulary." Drawing a house trains in the art of expressing forms and construction by the use of perspective; drawing a rabbit affords an exer-

cise for expressing action, growth and texture; drawing the human figure in action develops the art of expressing motion, action, growth and texture in living forms. The brush drawing of a tree, owing to the nature of the drawing material used and to the comparatively exacting technique, presents a number of new problems. Spreading color for artistic effects by means of a brush requires during the operation all the attention at the pupil's command. And for that reason, the factors of form, proportion, growth, texture, and light and dark must be duly considered before applying the brush. It is planned to present design and composition and color in Parts II and III, respectively, of the scale.

The drawings were catalogued by school grades, each grade being indicated by a capital letter. Each sample in a grade was given a serial number, and the themes were shown by digits placed as exponents on the sample's serial number, e. g., $B3^2$ signified sample Number 3 of First grade drawing, and, if in representation, the theme, rabbit. Then by indexing the books in which the drawings were listed, it was possible to locate a sample at an instant's notice.

II. METHODS FOR GROUPING THE SAMPLES

1. Status of the Judges

Ninety-two judges were engaged on this portion of the work—Part I. Of this number twenty-eight, or 30%, were teachers of art or supervisors of art in city public schools; forty-nine, or 54%, were teachers of academic subjects in public schools and colleges. Nine, or 19%, were art students, and 6% were educated laymen.

2. Step 1: Distribution of Samples Without and With Aid of Legend

A new scale in any of the common branches must henceforth justify its existence by functioning in the school room. Obviously, a scale for free-hand drawing must fulfill that requirement, must be of a sort that both pupils and teachers can readily *use* and be appreciably benefited by such use. This principle has controlled all matters bearing on the construction of the present scale and especially on the methods for selecting and scoring the samples.

It was early decided, as already observed, that the scale should be analytic, that the differences between the samples forming the scale should consist of differences in degrees of mastery of evident principles of drawing, that steps, so-called, in the scale should embody principles susceptible of simple description and at the same time exhibiting the probable order in which they are achieved by the learner.

The plan, here finally adopted, had its beginning in 1911, when one of the authors found it necessary to devise a method by which to score some 225 drawings. The material consisted of free-hand drawings of a rooster, made under three different conditions. The large number of specimens made the usual methods of rating, e. g., serial and alternate, impractical. An inspection of the drawings showed a wide range of achievements; some were so poorly done that the

intentions of the author were not revealed, other groups contained samples that represented a bird but left the species in doubt. Still other drawings represented a domestic fowl other than a chicken, etc. Working over the drawings in this fashion resulted in the formulation of a set of 'checks' by which the rating was eventually done. The 'checks,' with their arbitrary values follow:

1

A drawing that does not show the author's intention is rated..... 0

2

A drawing that represents a bird but leaves the species in doubt is rated 1

3

A drawing that represents a domestic fowl other than a chicken, as turkey, guinea hen, etc., is rated..... 2

4

A drawing that represents a hen or leaves the sex in doubt is rated 3

5

A drawing that represents a rooster, but is lacking in artistic form (wooden), is rated..... 4

6

A drawing that expresses fair proportions and qualities of life is rated 5-6

7

A drawing that shows skill in the use of line to express qualities of life and good form is rated..... 7-8

8

A drawing that shows good arrangement and skill in the use of line to express life and form is rated.....9-10

The value of such a crude set of 'checks' or legend is limited to the drawings of a special object; and, besides, only a few of the checks embody principles of art. The control that it afforded the judges, however, in rating the samples fully justified its use and suggested, at the time, the desirability of formulating a legend that would be uni-

versal in its application, and that would embody the essential principles of art knowledge. The sugestion was acted upon (Gertrude L. Carey) and resulted in the formulation of three legends: one for scoring drawings in representation, one for design and composition, and one for color. They embody the primary principles of the three phases of drawing arranged on a probable genetic and development basis, or roughly, in the order in which they are acquired by the pupil. Only the legend on representation is given in this report. Its present form is the result of several revisions made in the light of years of experience in teaching and in directing art education in city public schools.

A. WITH AID OF UNWEIGHTED LEGEND

(Sixteen Judges Were Asked to Make the Preliminary Distribution)

Two of the judges were art supervisors, one an art teacher, two were art students, one an art connoisseur, and ten were regular teachers of academic subjects. The numerical values assigned to the principles grew apace with rough and tentative distributions of the drawings. When guided by the legend (unweighted), the judges experienced but slight difficulty in distributing a thousand or more samples into seven piles, and had considerable confidence with the majority of the classifications. Of course, they were often confronted with samples showing one or more drawing principles applied with some excellence, but markedly deficient in some other; and likewise, samples appeared on the borderland between two sets of consecutive principles.

These rough distributions piled the drawings from any school year high at the simpler end of the legend and thinned them out at the approach of the difficult end. The drawings in the large piles answering to the simpler principles showed wide differences in quality, while those of the better types, embodying higher principles of the legend, increased in similarity, and as a consequence, grades of difference grew markedly less. The drawings of the four themes followed the same principle.

B. WITHOUT AID OF LEGEND

It seemed desirable at this point to distribute the drawings, without the aid of the legend, into as many groups as qualitative differences could be discriminated. Four judges worked under these conditions. Two were graduate students in The Johns Hopkins University. One of these, who had formerly supervised drawing in the public schools, made 14 groups out of the houses—1487 drawings. The second student, who had taken general art courses distributed the rabbits—878, into 16 groups. A third judge, employed in an art store, an art connoisseur, distributed the 'figure in action' into 16 groups. The fourth judge, the writer, having a more intimate knowledge of the legend, was doubtless influenced thereby, made 18 groups of the rabbits, now to the number of 1022. The judges uniformly claimed that the capacity for discrimination improved decidedly with practice and believed that further practice would have increased the number of groups. These two lines of experience, (1) distributing the drawings under the control of the legend unweighted, and (2) distributing them without such control, and, in addition, the large number of samples to be handled, suggested that methods be devised whereby thousands of unsuitable drawings for scale making could be eliminated *under control,* and a few dozen fit samples be retained.

3. Step 2: Distribution of Samples With Weighted Legend for Purposes of Eliminating and Selecting Drawings

The preliminary work thus far suggested that rejecting and retaining samples could be accomplished by applying, throughout the distribution, the question: "Does the sample *possess* or *lack* this or that principle of the legend?" While this method made it possible to distribute the drawings under control into seven groups, it made no provision for rating the drawings within a group, drawings that showed wide varia-

tions of skill in handling the *same principle* or set of principles.

Observations on the progress of pupils' drawings from year to year (Gertrude L. Carey) has shown that more steps of marked improvement occur, as a rule, in the earlier years, and that the increments of improvement in the use of a given principle diminish gradually as maximum skill is attained. The same principle, of course, operates in the acquisition of any skillful art. For these reasons, it was decided to attach unequal weights to the drawing principles, weights of wide range at the lower end, and gradually narrowing toward the other. Henceforth, these numerical weights are referred to as *Group Scores*. There are six, not including the zero group. The fact that from 14 to 18 steps could be discriminated in these drawings and that the scoring process improved with practice, suggested that at least 20 steps of equal intervals should be provided and duly apportioned to the *score groups*. The number of equal steps (class intervals) assigned to a group score was based upon the number of differences sufficiently marked and characteristic, so as to permit description in untechnical language. By this method it was discovered that six steps could be made out in group score 2, the one above zero, that five steps existed in group score 3, and four steps in group score 4, and two each in group scores 5 and 6, respectively, and one step in group score 7.

The steps within a score group were raised to five units (the width of step or class interval) to avoid the suggestion of scoring to a mere point, and, besides, it expanded the range of the score groups from 0 to 100, which will likely prove convenient in the matter of standardization. Subsequent rating of samples showed, however, that they were rarely scored above the interval of 91-95, and thus the range from 0 to 100 proved entirely adequate for distributing the qualities of drawings now done in the public schools. The legend in its final form appears on page 14.

Drawings of the ZERO TYPE marked the starting point. To determine the next sample for the next step in the scale, the more usual method calls for one which 75% of the judges consider just better than zero; a third sample is one having the same percentage of agreement that it is just better than the *second* sample; and the fourth, fifth, etc., samples of the corresponding steps of the scale are similarly arrived at. We rejected this method for these reasons: (1) The desirability of securing a scale in terms of special values ranging from 0 to 100. (2) A drawing scale to function must embody principles and technique of drawing arranged on a progressive plan. Principles expressed in the samples of the scale must be chosen just as they are combined and applied by the pupil under conditions of learning; and the difference between successive steps should be sufficiently concrete so as to be recognized by the pupil, especially when described in simple language.

A sample, to be just better than zero in the present study, must have meaning as conditioned by the theme, but it must not possess principles of art as such. According to the legend, the sample must be "deficient in the elements of proportion, etc." The term 'deficient,' rather than 'lacking,' was preferred on the grounds that a drawing entirely void of proportion, etc., would also lack meaning. The legend provided for six degrees of meaning, for the reasons assigned above. A sample, to be placed just beyond the mere "meaning" group, must express an intentional use of an elemental art principle, e. g., proportion, balance, structure. Here five steps were formed. The principle governing the formation of the rest of the score groups may be made out from the legend.

LEGEND FOR SCORING DRAWINGS IN REPRESENTATION

Distinguishing principles of the groups	Group score	Score intervals
1		
A drawing that fails to express the intentional meaning of the pupil may be rated.....	0	0
2		
A drawing that expresses the intentional meaning of the pupil, but is deficient in the elements of proportion, structure, and action, may be scored from	1 to 30	1- 5 6-10 11-15 16-20 21-25 26-30
3		
A drawing that expresses action and the elements of proportion and structure may be scored from	31 to 55	31-35 36-40 41-45 46-50 51-55
4		
A drawing that expresses action and the elements of proportion, structure, relation of parts and perspective, but has a minimum of artistic qualities, such as growth, texture, and structure in living and constructed forms, may be scored from.....	56 to 75	56-60 61-65 66-70 71-75
5		
A drawing that expresses proportion, a knowledge of the fundamental principles of perspective, action in living forms, and some skill in the use of line and dark and light to show growth, texture and structure, may be rated from	76 to 85	76-80 81-85
6		
A drawing that shows proportion, a knowledge of perspective, of structural features, and of action and a more skillful use of line and dark and light to show growth, texture and structure in living and constructed forms, may be rated from.....	86 to 95	86-90 91-95
7		
A drawing that shows correct proportions and an understanding of the principles of perspective, of structural features and action, and considerable skill and feeling in the use of line and dark and light to show growth and texture may be rated from.....	96 to 100	

The photograph shows distribution under control of legend and of the 'type' drawing. Conceive the lower picture to be moved so that its left end adjoins the right end of the upper: thus arranging the score intervals in a continuous series, 0 to 96-100, from right to left. The small cards in middle row bear the score interval; the pile below contains samples judged equal in value to the score interval and the sample directly above is the 'type' of this score.

A copy of the directions for using the legend and for scoring the drawings was placed in the hands of the judges. The directions follow here.

DIRECTIONS TO THE JUDGES FOR SCORING THE DRAWINGS

You are asked to score in numerical terms drawings made to represent objects.

I

Read carefully the legend prepared to assist you in rating the drawings. It contains the primary principles of drawing arranged in the order in which they are usually mastered. You will note that the drawings may fall roughly into seven groups according as they possess, or lack, these principles, and into twenty-one groups according to the degree of skill shown in applying the principles.

II

To score a sample:

1. Observe what principles it embodies, e. g., look for (a) intentional meaning; (b) proportion and symmetry in parts, between parts, as a whole; (3) elements of perspective, growth, texture, and structure in living or in constructed forms, as shown by light and dark, and by line, etc.

2. Observe the degree of skill with which the principles have been handled.

3. From (1) and (2) determine the numerical score of the sample. Then place the drawing or sample on the score-table by the label bearing its score.

III

Labels have been provided for scores ranging from 0 to 100. If this range proves inadequate, make additional piles beyond the 96-100 limit: notice that each of the 20 intervals above 0 are divided into points. Make as many trials as you like until you are satisfied with the score assigned the specimen. Select a 'type' drawing for every pile that you make which expresses the principles of that score. Place the 'type' conspicuously by the side of its assigned score (label) so that it may aid in scoring other drawings.

IV

After having scored and placed all the drawings of a theme into the several score piles, arrange each pile, including its type, in a serial order, beginning with the poorest and ending with the best; in this case only one drawing can be assigned to a given position.

All scoring is to be strictly individual. Do not examine the back of the drawings.

4. USE OF "TYPE" DRAWINGS FOR CONTROLLING JUDGMENTS

In the preliminary distribution without the legend it was found that the last or top drawing of a group exerted an undue influence in scoring subsequent and somewhat similar samples. No marked errors occurred so long as the last

scored sample fell within the dominant features of the group. But it would happen that an irrelevant feature or an exaggerated accessory, e. g., an unusually good fire engine, or a house on fire in the drawings of the 'Figure in Action,' would appear in a sample and tend to detract attention from the essential features that should have prevailed in the distribution of the samples. To prevent errors arising from such a source, the judges were instructed in the 'directions' (see above) to select a representative or 'type' drawing for a score group as it was being formed and to place it conspicuously beside or in front of the score group. The drawings in front of the score groups in the accompanying photograph were the 'types' selected by a judge while scoring the brush drawing of a tree. The 'type' could be changed if a more representative one appeared. The judges were uniform in affirming that these 'types' stabilized their judgments.

As soon as a judge had completed a distribution of all drawings of a theme, the median sample for each pile of the 'score intervals' was found by arranging all drawings of the interval in a serial order from the poorest to the best. (See instruction to judges.)

5. Results from Preliminary Distributions

Since every sample was registered in ledger-fashion, it was possible to post its scores on the same line. A portion of such page appears here as a sample.

J 21^3 (15) 61–65; 71–75; 61–65; 66–70; 56–60.
J 22^3 (15) 76–80; 61–65; 66–70; 46–50.
J 23^3 (13) 66–70; 61–65; 71–75; 66–70.
J 26^3 (13) 46–50; 56–60; 56–60; 31–35.
J 27^3 (14) 76–80; 76–80; 86–90; 61–65.
J 28^3 (16) 81–85; 81–85; 91–95; 81–85. (checked.)

'J' means that these drawings were done by pupils of 9th grade, '3' means that they were 'figures in action,' number in parenthesis shows pupil's age, and the numbers to the right are the scores assigned by four different judges; specimen J 21^3 was scored by five judges.

Those samples receiving the same score by three of the four judges or by four of the five judges, or the same score by all of the judges were checked as possible specimens for the scale.

The drawings of 'house' were thus distributed by five judges, those of 'rabbit' by five, and 'figure in action' and 'brush drawing of a tree' by four judges each. Table IIa shows the results of a single distribution by one judge. Eighteen similar tables were constructed for as many complete distributions. Tables IIb, tree, and IIc, house, are the combinations of two and five tables, respectively, of single distributions. Eighteen similar tables are on file for every complete distribution.

A casual study of the tables show that the drawings of the first four years are largely scored within the first quarter range, 0-25, of the weighted legend, that the fifth, sixth, and seventh years are scored within the first and second quarter ranges, 0.45, and that the eighth, ninth, tenth, and eleventh are scored, for the most part, in the third quarter range, 50-75. Out of 680 houses done by the four higher grades (8, 9, 10, and 11) not quite seven per cent were scored in the fourth range, 76-100.

The drawings of grades five, six and seven were distributed with marked frequency throughout the range of the legend, and especially the drawings of the 'tree' and of the 'figure in action.'

The column headed 'Grade of Mode' shows the school year that contributed the most drawings to the score-step shown in the column to right of 'total'; e. g., in Table IIc, c means that the second grade contributed the most samples to step 26-30. The column headed 'Type' contains the symbols of drawings chosen by the judges as the most representative drawings in the respective score groups; e. g., in Table IIc, $K48^1$ means that the drawing bearing that symbol and done in the 10th school year was chosen to represent the score value of 51-55. The column headed 'Median sample' registers drawings that fell in the median position when all

TABLE IIa

Results of Rating Public School Drawings Done from Memory by All Grades

NAME OF JUDGE: MISS S———. NAME OF THEME: FIGURE IN ACTION

Number of School Grades: Kdg'ts. I II III IV V VI VII VIII IX X XI XII

Symbols for Grades	A	B	C	D	E	F	G	H	I	J	K	L	M						
Score Intervals.	0.0	9.22	14.08	16.86	18.09	24.32	32.49	33.68	95.50	68.49	71.61	68.99		Total	Grade of Mode	Type	4 Samples below Medians	Median	4 Samples above medians.
0	6	18	7		1	1	1							34	B	A 5			
1 – 5	3	32	22	13	2	3	2	4						81	B	B 60	C 119, B 15, B 109, B 51	B 64	B 49, B 103, C 58, B 69.
6 – 10	1	24	32	11	10	8	4	3	1					94	C	B 20		D 18	
11 – 15		21	46	27	11	14	4	8	0					131	C	D 48		C 166	
16 – 20		29	59	20	19	22	15	8	6					177	C	C 96	contained	G 25	contained
21 – 25		5	7	19	12	18	8	11	4					84	D	F 24	samples of	D 102	samples of
26 – 30		1	5	11	3	12	7	9	5	1				54	F	G 36	drawings	E 5	drawings
31 – 35		1	1	3	4	20	12	13	9	2		1		66	F	I 37	below	G 2	above
36 – 40				3	1	5	6	11	5		1	1		33	H	H 37	medians	F 43	medians (Near Medians)
41 – 45				1	1	7	14	2	4	2	2	2		35	G	G 47	(near medians)	D 3	
46 – 50						4	6	4	12	2	3	3		34	I	H 15		G 69	
51 – 55						2	9	7	2	3	2	2		27	G	J 38		H 63	
56 – 60				1	0	2	8	12	5	5	3	2		38	H	J 26		F 86	
61 – 65						2	9	2	5	6	5	4		33	G	L 16		J 41	
66 – 70							2	2	0	13	6	5		28	J	L 14		J 10	
71 – 75							3	2	4	7	4	6		26	J	L 19		J 23	
76 – 80							1	1	2	2	4	3		13	K	H 70		I 38	
81 – 85									2	5	4	2		13	J	L 10		I 1	
86 – 90							1	1	1	3	7	3		16	K	K 10		L 5	
91 – 95										4	4	2		10	K	K 4	J 28, J 6, K 12, K 2	J 1	J 17, K 3, K 1
96 – 100										–	–	–							
	10	131	179	109	64	120	112	100	66	55	45	36		1027					

Table IIa is to be read as follows: Of the ten kindergarten drawings of 'figure in action' six were assigned zero value, three were rated 1-5 and one 6-10; of the one hundred-thirty-one first grade (B) drawings, eighteen were rated zero value, thirty-two, 1-5, twenty-four were rated 6-10, etc. Reading from left to right, *e. g.*, the second horizontal line from top, the score interval 1-5 received 81 drawings ranging from the kindergarten (A) to the seventh grade (H). The first grade, 32 in number, formed the Mode, B60 formed the 'Type' and B64 the Median. Four samples recorded on either side of the Median 'B64' illustrates how 'near' medians were secured. In Table IIb these near medians are recorded in full. The median scores by Grades are to be read: First grade (B) is 9.22, second grade (C) 14.08, the third grade (D) is 16.86. These medians are used in plotting curves to show relative drawing achievements in the school grades as scored in distribution under control of Legend.

TABLE IIb

Showing Distribution of Scores on Tree by School Grades

COMBINED JUDGMENTS OF TWO JUDGES CONTROLLED BY LEGEND

Number of School Grades: Kdgtn. I II III IV V VI VII VIII IX X XI XII

Symbols for Grades		A	B	C	D	E	F	G	H	I	J	K	L												
Score Intervals	Grade in Mode	6.8	9.32	30.61	Medians 51.74	57.24	57.33	60.85	61.22	63.49	67.65	73.07		Total	Type	4 samples below median				Median Samples	4 Samples above median			
0	C	9	18	5	1									33	B168					C260				
1 – 5	C	16	38	8	9	2	1							74	D22x	C146	C16	B17	D161	B172	C63	B68	C196	
6 – 10	C	9	15	7	3	5	1	1						41	C190	E24	C16	B171	D161	G11	C225	C75	C79	C269
11 – 15	C	5	10	8	7	2	3	1	1					37	C186x	F19	C4	E35	C13	J30	C35	E107	F67	B152
16 – 20	C	6	10	4	4	3	6	3	1					37	D190	C9	D170	C68	C241	E156	G140	F62	G38	G51
21 – 25	F	3	10	6	3	11	4	1	1					39	E16x	F40	F52	E175	F36	F190	B13	H89	E123	F9
26 – 30	F	1	8	7	5	9	4	4	3					41	F1	F22	C234	C22	C15	C271	D153	F70	C247	D134
31 – 35	D	1	5	12	10	4	9	7	5		1	1		55	H23	C259	D114	D101	D14	D163	B113	B164	D139	H75
36 – 40	E	1	4	4	12	6	8	11	7		1			54	E12	F144	G37	D54	D168	G143	H59	G159	H58	F75
41 – 45	G		3	2	11	10	13	12	8		2	2		63	G77	I93	H92	G66	G34	F175	F150	G119	H77	H78
46 – 50	G	1	3	7	7	7	12	7	2		2	1		49	E78	G86	H80	G122	G123	G96	G80	E78	H174	H135
51 – 55	H	1	3	4	10	9	9	13	6		1	2		58	E168	H179	F146	G48	I74	G84	G165	H135	G120	H137
56 – 60	H		2	10	18	14	15	19	17	2	1	3		101	H27	J61	H14	F136	H173	H107	F94	H144	F102	H37
61 – 65	H		1	2	12	11	10	19	11	1	4	8		79	H180x	H29	H146	H156	E164	I1	F109	F113	F108	K9
66 70	G		1	2	7	13	17	14	9		3	5		71	F91x	G132	F105	H116	H151	H147	E113	F149	F50	F165
71 – 75	H		1	1	13	14	11	17	11	1	1	6		76	I67x	E163	E166	I97	I73	E100	G128	G91	F114	F91
76 – 80	F				8	20	13	19	14	1	3	6		84	H5-x	F97	F95	J67	G156	I74	I38	I58	H126	H5
81 – 85	G				5	2	9	7	6		3	5		37	I72	L12	F66	J60	H150	H78	G144	H180	E155	H17
86 – 90	L				2	1	3	1	1		2	5		15	L11	G44	G97	H134	L25	L11	K42	L9	L8	L10
91 – 95	L											4		4	L32	H177	G105	L28	L29	L32	L34	L39	H6	H4
96 – 100	K							1			2	1		4	L23	E161	L15	J47	F91	I67	G122	H18	H117	L35
		53	132	89	147	143	148	157	103	5	26	49	= 1052											

x Were selected for the scale.

This table is to be read as Table IIa.

TABLE IIc

RESULTS OF RATING 1487 PUBLIC SCHOOL MEMORY DRAWINGS.

WORK OF FIVE JUDGES. THEME: HOUSE

School Grades:	Kdgtn	I	II	III	IV	V	VI	VII	VIII	IX	X	XI															
Symbol for Grades	A	B	C	D	E	F	G	H	I	J	K	L															
Score Intervals.	Medians of Grade Distribution																								Total	Grade in Mode	Type	Four samples below median	Median sample	Four samples above median
	4.69	10.22	16.65	20.59	11.41	23.99	31.46	34.76	44.22	49.02	42.99	18.11															
0	7	6	2		2																				17	A	A37		O	
1 - 5	47	59	33	12	50	26	4	3	1		1														238	B	E27	B90, C4, C1, C37	B69	C34, F35, C81, 93
6 - 10	21	37	33	17	22	10	10	4	2	1	2														159	B	C32		E40	
11 - 15	9	25	28	16	18	10	8	8	2	2															126	C	F60		F27	
16 - 20	2	25	31	22	13	13	7	6	3	2	2														126	C	J26	Here were	D44	Here were
21 - 25	1	23	28	17	18	15	9	8	2	5															126	C	G23	placed some	G20	placed samples
26 - 30		12	23	16	8	16	16	13	10	3	7														124	G	K20	below median	C182	above Median
31 - 35	1	12	15	10	6	21	16	29	14	14	13	1													152	H	F41	(Near Medians)	I12	(Near Medians)
36 - 40		1	9	8	5	4	8	9	13	13	7	1													78	I	H5		I54	
41 - 45			2	5	2	7	8	13	9	17	8	2													73	J	G95		I47	
46 - 50				1		3	11	8	8	11	5	1													48	J	G101		I41	
51 - 55				1	1	3	3	5	4	9	3	3													32	J	K48		J5	
56 - 60				3	3	4	6	11	5	13	4	4													53	J	H120		K61	
61 - 65						2	2	5	4	10	6	2													31	J	H69		H69	
66 - 70				2	1	1	2	2	4	6	5	4													27	J	K43		K75	
71 - 75					2	1	1	2	3	10	4	5													28	J	K79		J109	
76 - 80								1	2	7	4	3													17	J	J14		J60	
81 - 85								1	2	3	5	2													13	K	K45		J1	
86 - 90									1	3	4	2													10	K	L4		K89	
91 - 95										1	3	1													5	K	L1		K88	
96 - 100									1		1	2													4	L	L3		L3	
Total =	90	200	204	130	151	136	111	128	90	130	84	33													1487					

This table is to be read as Table IIa.

TABLE IId

Showing Grade Distribution of Rabbit Drawings Under Control of Legend

School grades =	Kdgtn	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Symbol for Grades =	A	B	C	D	E	F	G	H	I	J	K	L	M

Score Intervals	Medians of Grade Distribution: 1.27	8.12	16.46	25.50	31.71	40.80	43.32	69.84	80.50	90.50	95.50	99.33	Total	Grade of Mode	Type	Four samples below median	Median sample	Four samples above median
0	38	29	28	7	5	2		3					112	A				
1-5	27	38	46	18	5	0							134	C	C21	B5, C105 C120 B11	C23	C107, G7, C98, D42
6-10	5	27	27	8	7	2							76	C	B94		B94	
11-15	1	17	22	22	6	5	2						75	C	D27		F57	
16-20		18	16	16	9	9	3	5	1				77	B	E31		E63	
21-25		5	8	13	12	5	8	2	1	2			56	D	E61		D113	
26-30		2	12	9	9	9	6	6	2	1			56	C	G8	Contained samples of drawings below median (near medians)	E60	Contained samples of drawings above median (near medians)
31-35		1	6	8	8	7	5	7	2	3			47	E	H68		D63	
36-40			3	6	8	6	13	10	6	7			59	G	F49		F38	
41-45			2	0	4	1	8	13	2	1			31	H	G42		G59	
46-50			1	3	2	0	5	14	0	1			26	H	E59		H101	
51-55				1	4	3	6	0	0	4			18	G	F7		G55	
56-60				0	2	4	8	12	1	1			28	H	G27		H40	
61-65				2	3	5	4	8	3	2			27	H	H101		J47	
66-70					3	4	2	11	13	7	2	2	44	I	G51		J17	
71-75					1	3	1	6	7	4	3	4	29	I	G69		H51	
76-80						1	2	6	5	12	0	3	29	J	I2		I16	
81-85								3	7	17	2	1	30	J	H106		I6	
86-90								3	3	15	4	5	1	31	J	H39		I9
91-95									3	7	5	3	3	21	J	K10		K10
96-100										6	6	2	2	16	K	J24	K2 J3 I29 J10	J19	L4 K8 K3 M2
Total =	71	157	171	113	88	66	73	109	56	90	22	20	6	= 1022				

To be read as follows: 27 kdgtn. samples, 38 first grade, 46 second grade, 18 third grade, 5 fourth grade were scored 1-5. The most frequent sample was C, second grade; the type came from first grade B94; the median came from second grade, C23. Four samples better and four poorer than median are shown in second and bottom line only.

the samples of an interval were distributed in a serial order from the poorest to the best. In addition to the median, four drawings just better, and four just poorer, than the median, were recorded as 'near medians' which afforded an additional control in selecting samples for further treatment. A complete record of such 'near medians' is shown in Table IIb. The computed median of each grade or school year distribution is given under 'medians' and just above the frequency distribution column of the grade.

In these and similar tables based upon the distribution of 'house,' 'rabbit,' 'figure in action,' and 'tree,' the drawings

TABLE III

SHOWING MEDIAN SCORE BY SCHOOL GRADES

(Distribution Under Control of Legend)

	School Grades												
Themes	Kdgtn.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
House ...	4.68	10.72	16.95	20.53	11.41	23.99	31.45	34.78	40.22	49.62	47.99	69.11	
Rabbit ..	0	6.27	8.12	16.46	25.50	31.71	40.80	43.32	69.84	80.50	90.50	85.50	94.33
Figure in action .	0	9.22	14.08	16.86	18.09	24.32	38.49	33.68	45.50	68.49	71.61	68.99	
Tree	0	6.80	9.32	30.64	51.74	57.24	57.33	60.85	61.22	63.49	67.65	73.07	

The Median Score was computed from the grade distributions shown in Tables IIa, b, c, and d. These Scores show roughly the Progress of Drawing through the grades as determined by the Legend distribution.

of each school year as shown by mode, type, median, and 'near median' samples, conform in the main, exception to be noted later, to the general order of the students' progress through the grades. The same fact is expressed about these four themes in Figure I, based upon the computed median of the scores in a grade distribution. See also Table III.

The rise of three of the curves is gradual, with no plateaus and with few set-backs. The house curve, with the exceptions of fourth and tenth year, is rather remarkable for its gradual uniform rise. But the achievements in the brush drawing of a tree follow quite another line of progress. Table IIb shows that samples from fourth (E), fifth (F), and sixth (G), grades were scored with well nigh equal frequency along with those of the junior and high school grades. The rise of the tree curve, Figure I, is steep until the fifth

year is reached, but from then to the tenth year, the improvement from year to year is slight, forming a marked plateau. A possible explanation of the form of the tree curve may be found by comparing the score values of the tree drawings

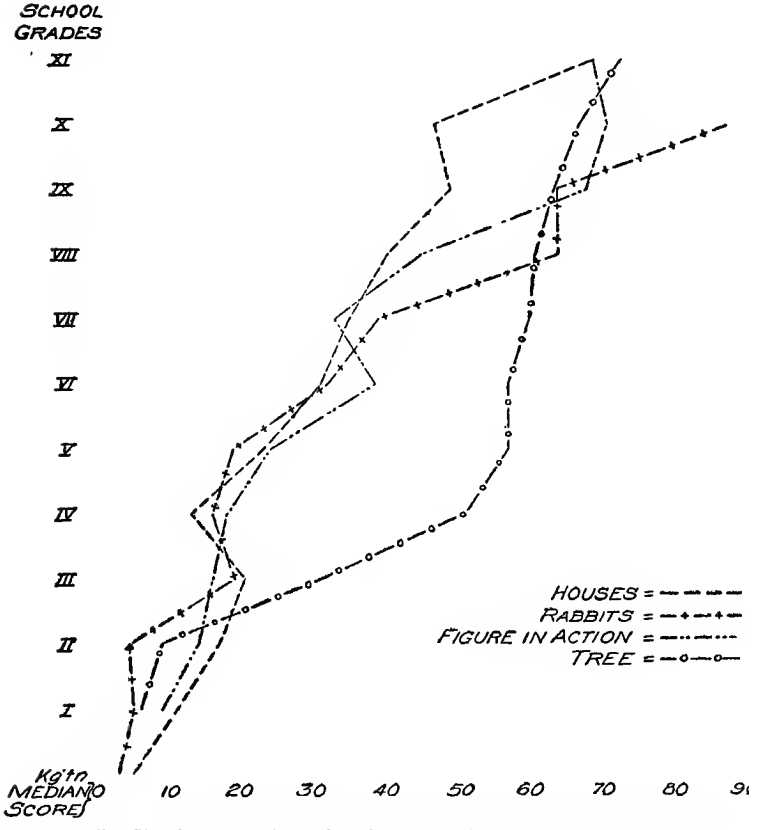


FIG. I.—Showing comparison of median scores by grades. Scoring controlled by legend and type drawing. (Rabbit curve based upon medians not given in Table III.)

with the principles of the legend. The third score group of the legend has a range from 31-55 (see legend for representation) and received drawings with degrees of merit in proportion and form. It appears that the use of the brush enables pupils in the earlier school years to achieve success

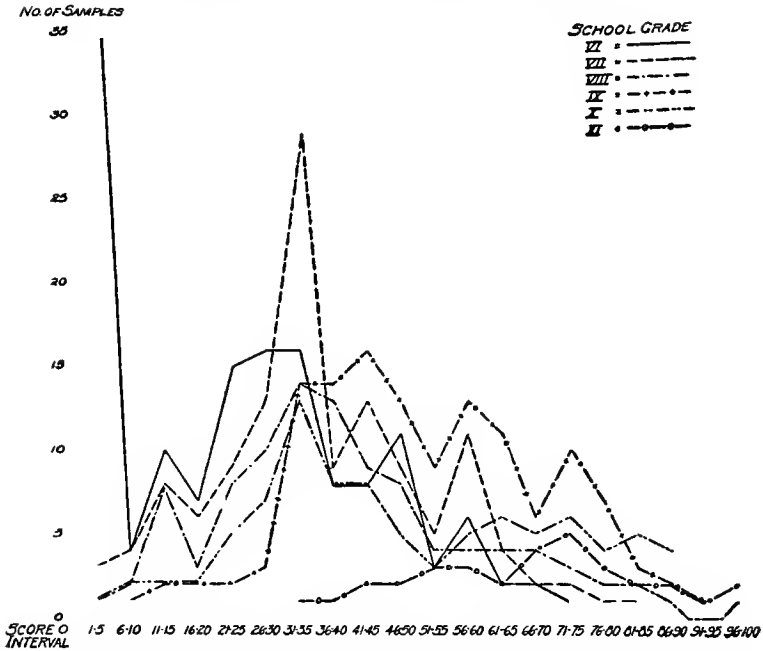


FIG. IIA.—Showing distribution of scores under control of legend on drawings of houses, 576, by school grades VI to XI.

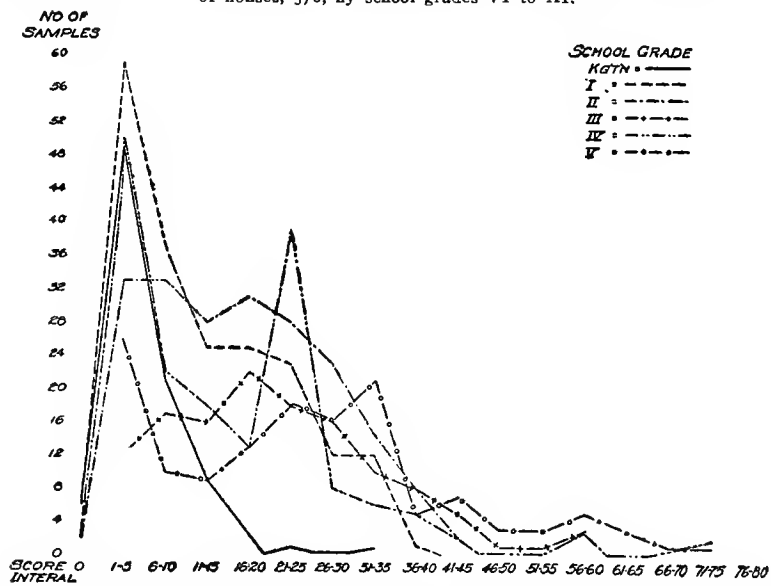


FIG. IIB.—Showing distribution of scores under control of legend on drawings of houses, 911, by school grades kindergarten to V.

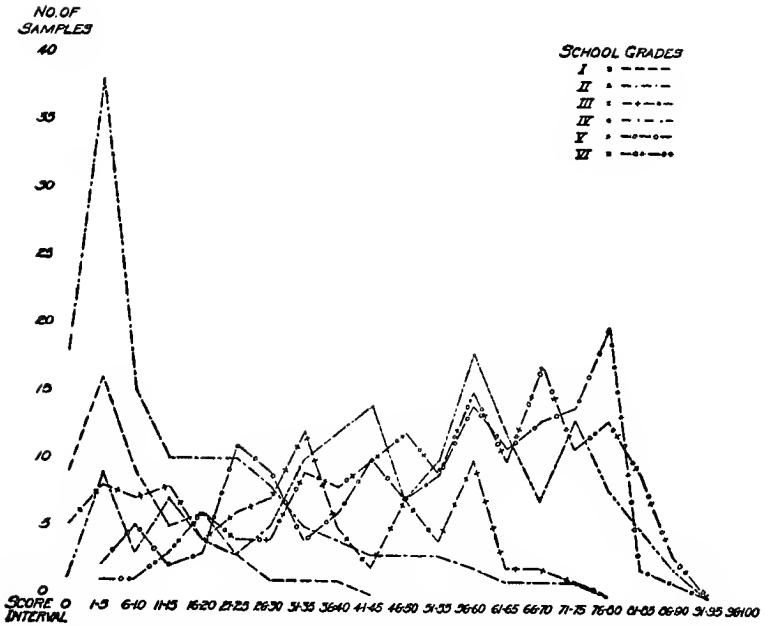


FIG. IIIA.—Showing distribution of scores on drawings of trees by school grades I to VI.

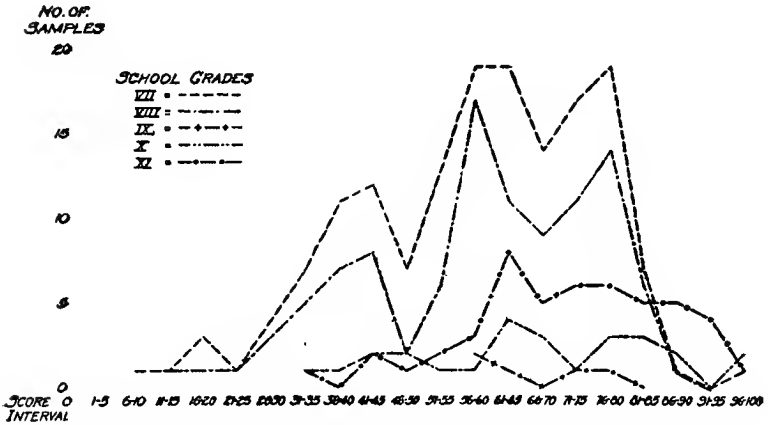


FIG. IIIB.—Showing distribution of scores on drawings of trees by school grades VII to XI. [Under control of legend.]

with this principle only. A drawing, to be scored higher than 31-55, for example in the 56-75 score group, must show "minimum of artistic qualities such as growth, texture and structure in * * * living forms." It should also be noted that defects in proportion and in relation between parts in a brush drawing of a tree are not as evident as the same qualities in a house, an animal, or in the human figure.

The tree drawings done by all of the higher grades, beginning with the sixth, expressed, according to the judges, only a minimum amount of the artistic qualities as specified in score group No. 4 of the legend. This fact doubtless accounts for the marked plateau in the tree curve. Similar plateaus in children's drawings, some beginning with the fourth year, have been found by Barnes, Lukens, Childs, and others.

There is a decided drop in house, rabbit, and figure in action curves, Figure I, at the fourth grade, and a similar drop in figure in action and rabbit occurs at seventh grade. This latter drop is made more noticeable by the rapid rise of both curves in the eighth and ninth grades. A consideration of the probable cause or causes of these fluctuations and sudden ascents is postponed to Part II, when more material is available.

Figures IIa and IIb of house samples, and those of IIIa and IIIb of trees, based upon the absolute number of score frequencies (Tables IIb of tree samples and IIc of house samples), show wide range of achievements in all school grades and marked overlapping in both directions; i. e., the scores of any grade coincide with those made by grades above and below it. House samples of third grade, for example, were scored from 1-5 to 66-70 and those of sixth grade from 1-5 to 71-75 showing a slight range above the third grade. This condition is similar to the findings of pupil achievements in other school subjects, as reading, spelling and writing (Starch, E. D.), arithmetic (Woody, C.) and in history (Bell and McCullum). An inspection of the figures shows, however, that the upper limits of the curves, with exception of that of house in tenth grade, end in the order of the priority of the school year.

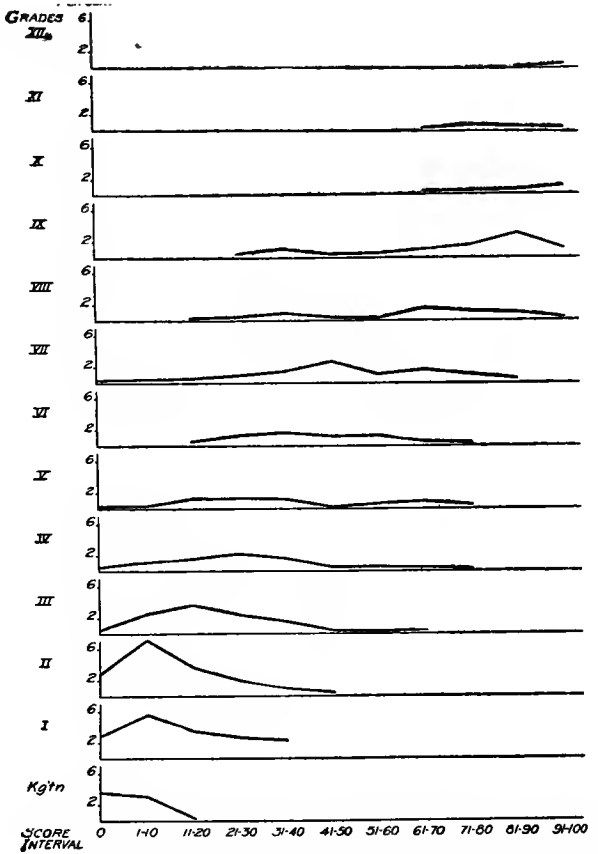


Fig. IV.—Showing overlapping of curves of rabbit drawings by school grades, based upon per cent of score frequencies.

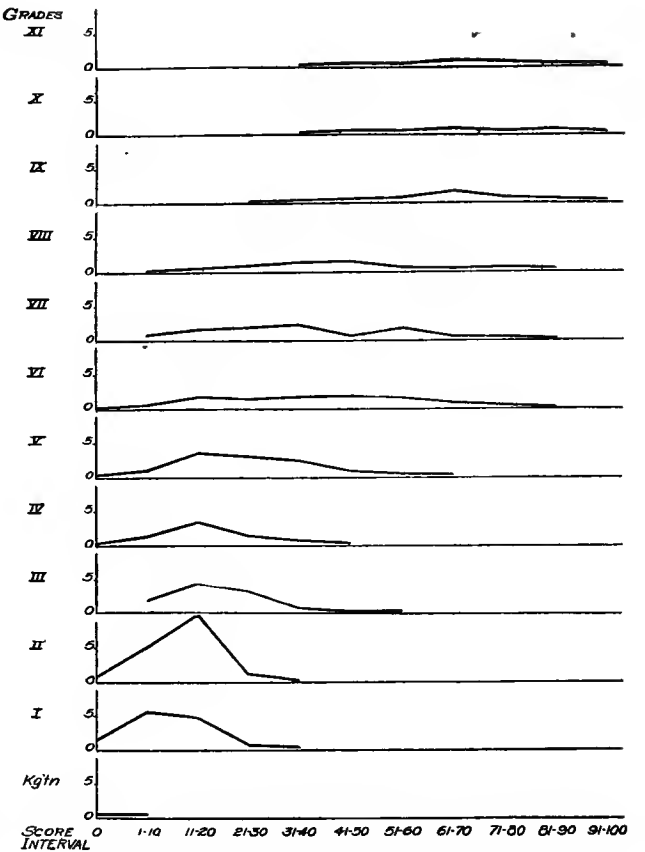


Fig. V.—Showing overlapping of curves of figure in action drawings by school grades, based upon per cent of score frequencies.

In order that the overlapping by grades may be more easily seen Fig. IV, 'rabbit' samples, and Fig. V, 'figure in action' samples, are constructed from per cents computed from the score frequencies per school grade, the total number of samples in each theme being taken as base. For example, the total distribution of rabbit drawings was 1022 (Table IIb). In grade I, 29 samples or 2.8% of 1022 were scored 0; 65 samples or 5.4% were scored 1-10; 35 samples or 3.8% were scored 11-20; 7 samples or .7% were scored 21-30; and 1 sample or .1% was scored 31-40. The score intervals of the weighted legend are doubled in the construction of these two figures.

These curves reinforce with some emphasis the phenomenon of overlapping and indicate a steady increase in achievement with the advance up the school grades. The curves also show that the score frequencies within the grade conform roughly to a normal probable error distribution.

III. SELECTING AND SCORING SAMPLES OF EACH THEME

1. Type, Median, Near Median, and 75%-Agreement Drawings Chosen

It was now possible to select drawings from four sources for further treatment: (1) those that had been 'types' during the distribution; (2) those that had been placed in the median position when the samples that had been given the same scoring were serially arranged; (3) those receiving the same score by 75% or more of the judges; (4) those that had been 'near medians' in the serial distribution of the scored drawings. It happened at times that the same drawing served as type, later as median, and finally received similar ranking by three-fourths of the judges. Samples that did not fall in one or more of these four classes were rejected. Samples having such a history or pedigree were used in making up a list of 63 drawings for the next type of scoring.

These 63 drawings selected under controlled conditions had a range of qualities embodying the essential principles of drawing in Representation and extending throughout the public school grades, i. e., they showed the entire gamut of drawing achievements as now done in the public schools.

2. Rating the 63 Samples by 22 Judges

The drawings were now re-scored by 20 or more judges under the guidance of the legend. The directions for scoring were similar to those used in the former distribution with the exception that the 'type' was omitted—no longer needed—and that the median was not placed or located among samples of each score interval by serial arrangement. The distribution was made on long tables (see photograph, page 14) and a sample was scored wherever it was deposited by a label bearing a score interval. Sixty-five of the 92 judges participated in this work. Twenty-four or 37% were teachers of drawing or artists, 34 or 52% were public school and college teachers, and 7 or 11% were laymen and art students.

TABLE IVa

Showing Distribution of Scores of 63 Samples Made by 22 Judges

Theme: House

No.	Name of Sample	Score Interval	0	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96-100	Median
1	A60		19	3																				0.0
2	A84		20	1	1																			0.0
3	B46		19	3																				0.0
4	A38		6	14	1	1																		2.79
5	B1			12	7	2	1																	5.58
6	B98			12	5	4				1														5.58
7	B4			7	11	1	1				1	1												7.82
8	A17		1	7	7	6				1														8.14
9	E27			6	10	3	1	1			1													8.50
10	C3			2	7	7	3				1			1	1									12.93
11	C32			5	3	4	8		1	1														14.76
12	B131				4	7	4	4	1	1		1												15.50
13	B144			1	6	3	8		2			1		1										16.63
14	B142				4	3	7	2	1	2	1	1	1											18.86
15	D69				2	7	3	2	2	4					1		1							19.33
16	B103				4	2	6	3	3	1	1		1		1									20.17
17	C100			1	4		6	5	1	3					1	1								20.50
18	C172				3	4	3	9	4	2		2				1								22.67
19	D44				2	4	2	8	1	2	1		1		1									22.88
20	C133				1	2	5	4	5	2					2				1					24.75
21	D59				2	4	2	4	3	4		1			1		1							24.75
22	E80					2	4	6	3	3	2				1	1								25.17
23	C126					6	2	3	3	2	2				3	1								25.50
24	C116				1		3	3	10			1			3		1							27.50
25	D64					2	4	2	4	3	2		1		2		1	1						29.75
26	G107					3		3	2	7	3	1		2	1									33.18
27	H97					2	4	1	2	3	3	1	1	3	1		1							34.33
28	H89					1	1	3	1	5	6	2		2	1									35.50
29	G101				1	1	4		2	2	7		4	1										36.71
30	G92					1	1	1		5	6	1	3	1	2			1						38.50
31	H108						2		1	3	10	3	1		1		1							38.50
32	H65					2	2		1	3	3	3	5		1	1	1							40.50
33	I5						1	3		3	2	5	3	3		1		1						43.00
34	I88								1	4	1	6	3	3	3	1								45.17
35	I39							3	2		1	5	3	3	1	1	1	1	1					45.50
36	H69						1	1	1	1	1	4	6	2		4	1		1					48.50
37	K8						1	1		1	2	3	6		3	2	2		1					49.50
38	K61								1	1	2	5	2	4	3		3		1					50.80
39	K53							2		1	3		2	6	1	3	3		1					53.50
40	H106									2		2	1	8	1	2	2		2	2				54.75
41	H5								3	1	2	2	1	2	1	2	2	3	3					55.50
42	I43								1		1	2	1	5	7		1	3	1					56.71
43	K84								1	2			4	3	5	2	2	2	1					57.00
44	K48					1				2			3	3	7	2	3	1						57.43
45	H120							1	1		1	1	3	3	1	5	4	2						60.50
46	L62										2		3	3	1	1	4	3	2	1	2			62.25
47	J126									1	1		2	2		4	3	4	2	3	1			62.67
48	J106												1	1	1		3	6	9	1				75.47
49	K46										1				1		3	3	7	1	2	3	1	78.14
50	J8														3	3		2	5	6	2	1		79.00
51	J59												2	2		1		1	8	4	3		1	79.13
52	J107												1	1		1	2	1	7	5	3	1		79.57
53	J127										1			1			2	2	6	3	4	2	1	80.17
54	K45									2							1	2	7	3	3	4		80.29
55	J109											1	1		1		3	2	1	8	3	2		82.25
56	J75													3		2			4	7	2	3	1	82.43
57	K67				1						1				1			2	4	7	1	3	2	82.43
58	K74								1	1							1	2	3	8	6			82.88
59	J60													1	1	1	1	2	2	7	2	3	2	83.14
60	K77												1	1					5	6	8		1	84.33
61	K75																2		2	6	8	3	1	86.43
62	K88															1	1				2	4	14	97.07
63	K89																					4	18	97.94

This Table is to be read: Sample B46 was scored 0 by 19 judges, and 1-5 by 3 judges. The median is 0. Sample A38 was scored 0 by 6 judges, 1-5 by 14 judges, 6-10 by 1 judge and 11-15 by 1 judge. The median $= 1 + \frac{11 - 6}{14} \times 5 = 2.79$. Samples underscored were later ranked in serial distribution.

TABLE IVb

Showing Distribution of Scores of 63 Samples Made by 22 Judges

Theme: Figure in Action

No.	Name of Sample	Score Interval	0	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96-100	Median
1	A2		19	1	2																			0.0
2	A5		20	2																				0.0
3	B23		18	1	2	1																		0.0
4	B38		16	2	1	2	1																	0.0
5	B69		5	12	2	1	2																	3.50
6	B62		1	11	1	4	1	3	1															5.00
7	B86		1	10	4	4	1	1		1														6.00
8	B120			7	5	2	1	2		1														8.22
9	B95			8	6	4		1	1	1	1													8.50
10	B116		2	2	10	3	2	1	1	1														9.50
11	D42			7	5	4	2	1	2				1											10.00
12	B92		1	9	1	4	1	1		1		3	1											10.50
13	B44			2	9	3	3	1	1	1	1		1											10.50
14	B115			2	6	8	3	4	1	1				1		1								15.50
15	C125		1	4	3	2	3	1	2	3	1			1	1									17.67
16	D77			4	1	4	4	1	5	1	1		1											18.50
17	C150				2	7	3	1	1	3	2	2		1										19.33
18	D87				2	5	4	1	1	1	1		3	1	3									20.50
19	D44			2	2	5	2	3	2	1	3	1	1											20.50
20	C119			1	5	1	2	4	3	5	1													23.50
21	C129			1	1	4	3	3		2		5		2	1									24.33
22	B104				2	4	2	4		3	1		2	1		3								24.75
23	C86				4	3	1	3	2	1	3	1		4										25.50
24	F86				2	1	5	3	3	1	2	1	1	2		1								25.50
25	D61				1	5	3	1	4	1	2			1	1	3								27.25
26	F79				3	2	2	3	4	2	1			2	3									27.25
27	D3			2	3		3	2	3	3	3	1	2											27.67
28	G35					1	4	3	4	1	2	2	2	2	1									29.75
29	C13				1	1	3	3	3	1	2	3	3	2										30.50
30	C144				2	2	3	3	1	3		2	1	2	2	1								30.67
31	D45				2	2	4	1	1	3	7			2										32.67
32	J36					1		2	3	2	4	3	3		2	1	1							39.25
33	D98				1	2	2	4			2	2	2	1	3		3							40.50
34	G4				1	1	1	2	3	1	2	1	4	3	1	2								40.60
35	L4					1		1	2		1	5	3	3	5		1							47.67
36	J10							1	2	1	1	5	1	1		4	2	4						50.50
37	L16								3	1		2	2	3	3	4	1	2	1					55.50
38	L19					1				2	1	2	1	2	5	4	1	1		2				58.0
39	K18									1	1	2	3	2	3		1	5	3		1			59.25
40	K27								1		2	1	3	1	3	3	3	4	1					60.5
41	K1							1			2	1	4	1	1	2	3	7						63.50
42	K10						1		1	1	1			3	2	3	2	2	2	2	2			64.33
43	L33									1		1		4		6	5		4			1		65.17
44	L30									1		2	4	1		3	4	3	2	2				65.50
45	J9													3	2	5	3	5	2		1	1		67.67
46	J12												3	1	2	3	5	3		5				68.00
47	J19								1	1			2	1	1	4	2	2	2	1	3	2		68.5
48	L45								1	1			1	1	1	3	2	3		6	2	1		72.67
49	G92							1				1	1	1	1	3	2	2	7	1	1	1		73.5
50	K6							1				1	1	3	1		1	4	6	2	2			74.25
51	J8								1		1				4	2	2	1	3	4	1	1	2	75.5
52	J11												2		5	2	1	1	4	7				75.5
53	J26										1		2	2	1	1		4	1	4	4	2		75.5
54	L10									1			1	3	4	1		1	4	5	2			75.5
55	A20								1		1	1	1	2	2		1		2	3	4	3		78.5
56	L5												1				1	3	6	4	2	4	1	80.67
57	J1												1				4	3	3	6	3	2		81.5
58	K3										1						1	2	7	1	6	4		90.5
59	L1													1	1		2	1	3	4	5	4	1	84.75
60	J17															3	1	1	1	2	11	3		87.3
61	C58															2	1	1	3	1	2	5	7	92.0
62	K4																		1	3	1	9	8	94.3
63	K21																		1		6	3	12	96.0

To be read as Table IVa.

TABLE IVc

SHOWING DISTRIBUTION OF SCORES ON 19 OF 63 SAMPLES MADE BY 21 JUDGES

Name of Sample	Score Interval	0	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96-100	Median
	Theme: Rabbit																						
B27		11	10																				0.0
C23		4	8	6	2	1																	5.0
E53		1	3	6	6	3	1			1													11.4
E73			1	3	6	5	3	2				1											16.5
E63			2	4	1	4	6	2		2													20.3
E60			1	1	5	1	6	4	1	2													23.0
D57					1	2	6	3	2	1	3	1	2										28.5
F49			1	2	1	2		4	1	3		3	1		3								33.5
H97						4		1	1	5	2	1	1	1	1	2	2						40.5
D63						1	1	1	4	2	4	2	1	4				1					42.5
H63						1	2	2	1	1		7	4	2			1						48.5
H60						1		2		2	2	4	3	5	1	1							60.3
H51										2	2	1	2	6	5		2	1					64.9
J47									1				4	2	1	3	7	3					70.1
J49												1	3	1		2	2	3	7	1			76.1
I24												1	1		1	2	3	3	2	3	2	3	80.1
I9															2		1	3	5	4	3	3	85.5
H109											1				1	1	3	1	1	5	4	4	89.5
K10															1			1	6		9	4	92.3

This Table is to be read as IVa. [Only 19 of 63 samples that were distributed appear here. Sample H63 should have been omitted. Since 42 of the original 68 were discarded there is no necessity for presenting their scores. Tables IVa and IVb show the character of the whole distribution.]

TABLE IVd

SHOWING DISTRIBUTION OF SCORES ON 19 OF 63 SAMPLES MADE BY 20 JUDGES

Name of Sample	Score Interval	0	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96-100	Median
	Theme: TREE.																						
B10		14	6																				0.0
D22		2	10	6	1		1																5.00
F4			3	5	3		4	3	1	1													19.33
E16		1	2		6	2	4	1	2	1													18.50
C186			1	2	3	4	1		8		1												20.50
G85				1		1		4	1	6		1	3	1		1	1						38.50
F124					1	1		2	2	3	2	2	1	4	1	1							43.50
H176							1	1		1	1	2	2	6	1	1	1		3				57.67
F178										3		2	4	1	4		3		2	1			60.50
H169										1		4	1	3	3	2	2	3	1				62.67
F161							1	1			1		1	3	5	2	2	1	2		1		64.0
I61						1				1	1	3	2		2	3	3	3	1				65.50
H5										1	1		2	1	1	3	2	2	4	2		1	73.50
F153															4	1	2	3	6	3	1		80.50
H180										1				1	3	2		3	1	4	4	1	80.50
I65																3	2	6	5	1	1	2	80.17
F91															1			5	4	6	1	3	85.50
G43								1					1			1	1	2	1	3	8	2	90.50
L10								1									1	3	2	1	4	8	93.50

This Table is to be read as IVa.

TABLE V

SHOWING HISTORY OF A FEW OF THE 63 SAMPLES CHOSEN FOR FURTHER DISTRIBUTION *

Theme	Name of sample	Median	Near median	Type	75%-Agreement
House.	B 1[1]	Median	.....	.....	.....
	A 17[1]	.....	.....	Type	.....
	B 131[1]	.....	Near median	.....	.....
	K 89[1]	.....	.....	Type	75%-Agreement
Rabbit.	K 10[2]	Median	.....	Type	.....
	I 9[2]	.....	Near median	.....	.....
	J 47[2]	.....	.....	Type	75%-Agreement
	E 60[2]	Median	.....	.....	.....
Figure in action.	A 5[3]	.....	.....	Type	.....
	K 37[3]	.....	.....	.....	75%-Agreement
	K 2[3]	.....	Near median	.....	75%-Agreement
	L 5[3]	Median	.....	.....	75%-Agreement
Tree.	H 180[4]	.....	.....	Type	.....
	I 61[4]	Median	.....	.....	.....
	L 10[4]	.....	Near median	.....	.....
	E 16[4]	.....	.....	Type	75%-Agreement

* It should be borne in mind that three samples were chosen for each of the score intervals ranging from 0 to 100, e. g., three drawings rated 1-5 were placed in the 1-5 interval, the three in each interval being of about the same value, of course.

3. BASIS FOR SELECTING 21 SAMPLES

A. DISTANCE BETWEEN MEDIAN SCORES

The results of scoring the 63 samples of each theme are assembled in Tables IVa, b, c, and d. Tables IVb and IVd present only those samples that were later chosen for scoring in the serial distribution.

Since 21 score intervals appeared to have sufficed thus far for scoring purposes, it was decided that the authors should select 21 samples from the 63, discarding 42, and have them redistributed serially, i. e., have them arranged in a series from the poorest to the best.

The samples are listed in the tables according to the array of the median values computed from 20 or more judgments on a single sample. A study of the tables shows that the difference between successive medians in the array for

figures in action varies from 0 to 5 units, for houses from 0 to 11.09 units; this latter difference occurs next to the last in the array and is more than twice the size of the usual largest steps. The distance between the steps, according to the medians, in the rabbit array—not shown in the table—varied from 0 to 5.83 units, and the distance between steps in tree array varied from 0 to 8.08.

The number of times in which there was zero difference between adjacent medians in scoring the drawings of the house was 6, the number for the tree scoring was 7, and in the case of the rabbit and figure in action 11 and 13, respectively. It is suggested that the relatively small number of zero differences between adjacent medians occurring in the case of the house drawings point to a greater variety of distinctive, progressive, and recognizable differences. The fine graduated differences in the living forms, rabbit and figure in action, are much more difficult to discriminate, and as a consequence, a greater similarity of grouping occurs. The average difference between the medians is highest for the house drawings, 1.99 units, while for the tree it is 1.33. The average difference for rabbit and figure in action stand 1.37 and 1.48, respectively; the greater difference of the figure in action is not clear.

It would have been possible, if desirable, to have selected 12 or 15 samples from the 63 with well nigh equal differences between their medians. Fourteen samples, not including zero, whose successive medians differed each by an interval of 6- and A D-.22 could have been selected from the drawings of rabbits. Thirteen whose medians differed by an interval of 6.46, A D-.63, could have been selected from the drawings of houses. Fifteen samples whose medians differed by a constant interval of 6, A D-1.2, could have been selected from drawings in action. When other conditions were equal, equal differences between medians determined the selection of the sample. In Tables IVa and IVc, the symbols of samples and the medians in heavy type mark the drawings selected for further scoring.

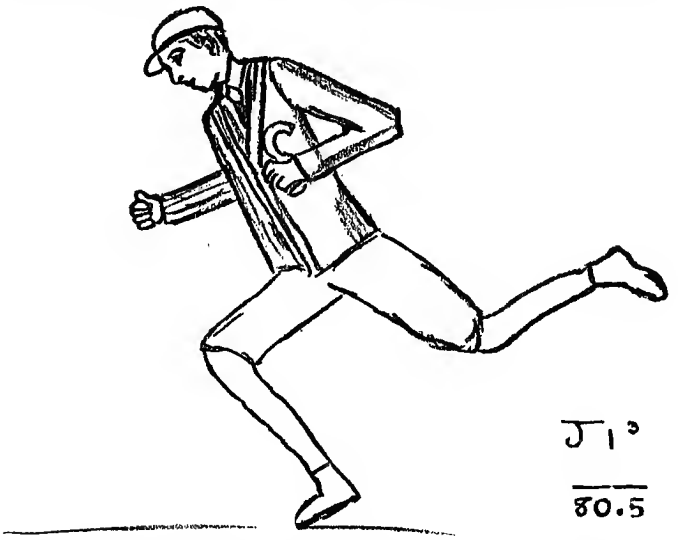
B. ACCORDING TO PRINCIPLES EMBODIED IN THE LEGEND

If equality of steps between the units of an educational scale had been the only object of the search, the investigation might well have stopped here. But when the samples having medians differing by equal intervals were compared with others having unequal intervals and both were checked by the principles of the legend, it was strikingly evident that

some samples occupying equal steps were easily surpassed by others having unequal steps for purposes of scale construction, e. g., in the figure in action samples $K6^3$ and $J8^3$ were rated 74.7 and 75.5, respectively, by 22 judges, and in the process of reducing the number of drawings from 63 to 21, obviously, one of these must be rejected. While $J8^3$ has defects as a drawing of a figure in action, as a whole the proportions are better, the lines more expressive, and the manner of suggesting the features more desirable at this *step*

in the scale. *K6*[3], while expressing action unmistakably, represents so many undesirable features, such as undue attention to details, lack of structure and proportion, rather than an effort to express the main action lines, through a study of direction, proportion, and subordination of details, it would, obviously, be of far less use to the pupil and teacher than *J8*[3].

Again, samples *J1*[3] and *I5*[3] were rated 80.5 and 80.5, respectively, by 22 judges, and as such were competitors for a



place in the scale. While *J1*[3] has much to recommend it as a type of the figure in action, the lines are hard and angular, have less variety and character, and are less expressive of the human figure than those of *I5*[3], making *I5*[3] a better type of drawing for use in the school room *at this step* in the scale.

A third principle somewhat coordinate with those of " A " and " B " employed in reducing the 63 samples to 21 consisted in making use of some characteristic, other things being equal, possessed by a sample over others that qualified it for measuring drawing achievements in the school room.

This factor will appear upon reading the "analytic description of samples" given in some detail with the scale pictures. A concrete case may be in order here, however. Sample *A17*[1], median value 8.14, No. 3 in the house scale, competed with two other samples having medians 7.8 and 8.5, respectively, and was chosen because it represented more clearly than either of the other two the common failure of pupils at this step to distinguish between the upright line that represents a corner of a building and the line that forms a part of the gable end. The two lines are drawn by the pupil as one and the same straight line.

The 63 samples of each theme were repeatedly worked over in this way until a set of 21 samples were chosen.

4. Scoring 21 Samples by Serial Distribution

The directions to the judges for this final scoring were as follows

To the Judges:

You are asked to arrange the 21 drawings enclosed in this envelope in order from the poorest to the best, and record the order that you assign to each drawing on the enclosed blank sheet.

In judging the drawings consider them from the standpoint of "representation" only. Observe such features as proportion, balance, light and shade, and quality of line to show growth and texture.

The legend was not used.

Thirty-two of the 92 judges scored the drawings by the serial method. The status of the judges in their relation to art knowledge and experience is given here in tabular form.

Drawing theme	No. of judges who taught drawing	No. of judges who had not taught drawing
House	7	7
Rabbit	10	2
Figure in action	7	5
Tree	1	13

A. Results of Serial Distribution

Tables VIa, b, c, and d show the results of the serial distribution: the medians, and the per cent rank of each sample in the total distribution. The high degree of correlation between the array of the per cent ranks of the serial

TABLE VIa

Showing Judgments in Serial Distribution of House Samples [14 Judges]

Rank	0		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		Median	Percent Rank
Named Sample	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%		
1 A60	14	100																																									0.00	0.00
2 B1			11	78.57	3	21.43																																					1.64	5.77
3 A17			3	21.43	10	71.43	1	7.14																																			2.40	8.84
4 B131					1	7.14	8	57.14	3	21.43	2	14.28																															3.75	16.33
5 B112							2	14.28	7	50.00	2	14.28	3	21.43																													4.71	21.08
6 D59							3	21.43	1	7.14	7	50.00	3	21.43																													5.43	22.45
7 D14									1	7.14	2	14.28	6	42.85	4	28.57			1	7.14																							6.60	29.59
8 H59													2	14.28	8	57.14	3	21.43	1	7.14																							7.67	34.35
9 G92									2	14.28	1	7.14					7	50.00	2	14.28	2	14.28																					8.57	35.71
10 K53															1	7.14	4	28.57	5	35.72	4	28.57																					9.40	42.17
11 H69															1	7.14			3	21.43	3	21.43	5	35.72	2	14.28																	11.00	48.64
12 H120																			2	14.28	4	28.57	6	42.86	2	14.28																	11.17	50.34
13 J62																					1	7.14			5	35.72	5	35.72	2	14.28					1	7.14							13.20	62.04
14 H106																							3	21.43	3	21.43	1	7.14	3	21.43	3	21.43	1	7.14									14.00	63.00
15 J59																									2	14.28	3	21.43	5	35.72	2	14.28	2	14.28									14.40	66.33
16 K46																											2	14.28	3	21.43	5	35.72	1	7.14			3	21.43					15.40	72.10
17 J3																											1	7.14			4	28.57	7	50.00	2	14.28							16.29	74.50
18 J109																													1	7.14			2	14.28	9	64.30	2	14.28					17.44	80.95
19 K75																											2	14.28							2	14.28	9	64.30			1	7.14	18.33	84.01
20 K89																																							12	85.72	2	14.28	19.58	91.15
21 L200																																	1	7.14					2	14.28	11	78.57	20.31	93.20

Table to be read: Sample A60 was assigned zero rank by 14 judges. Sample A17 was assigned rank 1 by 3 judges, rank 2 by 10 judges and rank 3 by 1 judge. The median for this sample is $2 + \frac{7-3}{10} = 2.40$, and the per cent rank in the total distribution is $\frac{(3 \times 1 + 10 \times 2 + 1 \times 3)}{294} \times 100 = 8.84$.

TABLE VIb

Showing Judgments in Serial Distribution of Rabbit Samples [12 Judges]

Sample	Key	0		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		Median	Percent Rank
		Ranks																																											
		No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%		
1	B27	10	83.33	2	16.66																																							0.00	.79
2	C23	2	16.66	10	83.33																																							1.40	3.96
3	F57					10	83.33	1	8.33			1	8.33																															2.60	11.11
4	G73					1	8.33	8	66.66	1	8.33	1	8.33	1	8.33																													3.63	16.27
5	B63					1	8.33	1	8.33	5	41.66	1	8.33	4	33.33																													4.80	21.42
6	D57							1	8.33	4	33.33	3	25.00	1	8.33	3	25.00																											5.33	24.20
7	E60									1	8.33	5	41.66	3	25.00	2	16.66	1	8.33																									5.80	27.38
8	F49									1	8.33			3	25.00	4	33.33	1	8.33	2	16.66			1	8.33																			7.50	34.52
9	D63											1	8.33					6	50.00	3	25.00	1	8.33	1	8.33																			8.83	40.07
10	H97							1	8.33							2	16.66			3	25.00	5	41.66					1	8.33															9.50	42.46
11	H63															1	8.33	3	25.00	2	16.66	4	33.33	2	16.66																			9.50	44.04
12	H60																					1	8.33	5	41.66	6	50.00																	11.50	54.36
13	J49																			2	16.66	1	8.33	1	8.33	2	16.66	2		1	8.33	3	25.00											12.50	58.73
14	J47																	1	8.33					1	8.33	1	8.33	3	25.00	4	33.33	1	8.33			1	8.33							13.50	62.62
15	H45																									2	16.66	3	25.00	2	16.66	2	16.66	2	16.66			1	8.33					14.50	68.85
16	H51																									1	8.33	2		1	8.33	2	16.66	3	25.00	2	16.66	1	8.33					15.50	72.22
17	E29																							1	8.33			1	8.33	3	25.00	4	8.33	4	33.33	2	16.66							15.50	71.03
18	E24																													1	8.33	1	8.33	2	16.66	3	25.00	5	41.66					16.27	80.15
19	E9																															2	16.66	1	8.33	4	33.33	4	33.33	1	8.33			17.75	81.34
20	H109																																					1	8.33	10	83.33	1	8.33	19.50	90.47
21	K10																																							1	8.33	11	91.66	20.45	94.84

The per cent of number of judgments made for each position in ranking a sample is given in Tables VIa, b, c and d to show the possibilities of using the principle of "over lapping" medians to compute distance between them. See Table VIIa.

TABLE VIc

Showing Judgments in Serial Distribution of Figure in Action Samples [12 Judges]

	Name of Sample	Ranks 0		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		Median	Percent Rank
		No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%		
1	A5	12	100																																									0	
2	B68			12	100																																							50	4.76
3	B86					5	42.66	6	50	1	8.33																															3 7	12.70
4	D42					4	33.33	5	42.66	1	8.33	2	16.66																													3 40	14.68
5	C119					2	16.66			3	25.00	2	16.66	4	33.33	1	8.33																									5 50	22.61
6	F79					1	8.33			3	25.00	2	16.66			5	42.66					1	8.33																			6 00	27.38
7	D98							1	8.33	1	8.33	1	8.33	1	8.33	1	8.33	4	33.33	1	8.33	2	16.66																			8 25	34.12
8	C150									2	16.66	1	8.33	3	25.00			3	25.00	1	8.33	1	8.33			1	8.33															7 00	34.12
9	B115													3	25.00	4	33.33	3	25.00	1	8.33	1	8.33																			7 58	35.31
10	C93									1	8.33	2	16.66	1	8.33	1	8.33			2	16.66	2	16.66	2	16.66	1	8.33															9 50	39.28
11	D104											2	16.66					1	8.33	5	42.66	2	16.66	2	16.66																	9 60	41.66
12	K37																	1	8.33	1	8.33	3	25.00	2	16.66	2	16.66	3	25.00													11 50	52.38
13	L16																			1	8.33			6	50.	3	25.00			2	16.66													11 83	55.15
14	J8																									3	25.00	4	33.33	3	25	2	16.66											13 75	63.49
15	L5																									1	8.33	2	16.66	2	16.66	2	16.66	3	25	1	8.33	1	8.33					15 50	71.03
16	J14																									1	8.33	2	16.66	2	16.66	2	16.66	1	8.33	3	25	1	8.33					15 50	71.82
17	I5																											1	8.33	1	8.33	1	8.33	5	42.66	2	16.66			1	8.33	1	8.33	16 60	77.38
18	I58																													2	16.66	1	8.33	1	8.33	2	16.66	2	16.66	3	25.	1	8.33	17 50	81.74
19	K3																															1	8.33	2	16.66	3	25.00	4	33.33	2	16.66			17 50	82.53
20	K2																															3	25			1	8.33	3	25	4	33.33	1	8.33	18 66	84.12
21	J18																																					1	8.33	2	16.66	9	75	20 33	93.65

Table to be read as VIa. Array of samples according to per cent rank instead of median rank.

TABLE VId

Showing Judgments in Serial Distribution of Tree Samples [14 Judges]

No	Name of Sample	Ranks 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Median	Percent Rank
		No. %	No %	No %	No %	No %	No %	No %	No %	No %	No %	No %	No %	No %	No %	No %	No %	No %	No %	No %	No %	No %		
1	B10	14 100																					0.0	
2	D22		14 100																				1.50	4.76
3	F4			9 64.28	4 28.57	1 7.14																	2.67	11.56
4	E16			3 21.43	5 35.71	4 28.57	2 14.29																3.80	15.98
5	C186			2 14.29	4 28.57	6 42.86	2 14.29																4.17	17.00
6	G85					1 7.14	4 28.57	3 21.43	3 21.43	2 14.29	1 7.14												6.67	28.93
7	F124				1 7.14		3 21.43	4 28.57	3 21.43	1 7.14			2 14.29										6.75	31.63
8	H176					2 14.29	1 7.14	4 28.57	1 7.14		1 7.14		3 21.43	2 14.29									6.50	32.41
9	H173						2 14.29	3 21.43	1 7.14		3 21.43	1 7.14	1 7.14	1 7.14	1 7.14	1 7.14							9.33	38.09
10	I67								5 35.71	2 14.29	1 7.14	1 7.14	2 14.29	1 7.14			2 14.29						8.50	45.75
11	F178								1 7.14	3 21.43	2 14.29	2 14.29	1 7.14	1 7.14	2 14.29	1 7.14	1 7.14						10.50	50.00
12	H169									2 14.29	1 7.14	4 28.57	1 7.14	1 7.14	2 14.29			3 21.43					10.50	55.10
13	I61									1 7.14		3 21.43	3 21.43	3 21.43	1 7.14	1 7.14	1 7.14	1 7.14					11.50	56.05
14	E161									1 7.14	2 14.29	3 21.43	1 7.14	1 7.14		2 14.29		4 28.57					11.50	58.16
15	G43									2 14.29				2 14.29		2 14.29	2 14.29	1 7.14	3 21.43	2 14.29			15.50	68.36
16	H5										3 21.43			1 7.14	2 14.29			1 7.14	5 35.71		2 14.29		16.50	69.38
17	F91														2 14.29	2 14.29	2 14.29	2 14.29	4 28.57	1 7.14		1 7.14	16.50	75.51
18	I65														1 7.14	3 14.29	3 21.43	1 7.14		4 28.57	2 14.29		15.50	76.88
19	F153													1 7.14	1 7.14	1 7.14	1 7.14		2 14.29	4 28.57	2 14.29	2 14.29	18.25	80.95
20	L10														2 14.29	1 7.14	2 14.29	1 7.14			5 35.71	3 21.43	19.20	87.97
21	H180																			3 21.43	3 21.43	8 57.14	20.13	92.17

Table to be read as VIa. Array of samples according to per cent rank instead of median rank.

distribution and the array of the medians of the "legend distributions" (Tables IVa, b, c, and d) offers a somewhat mutual check on the validity of the two methods. Pearson's "Method Adapted to Rank Difference" was used. The formula, in which r is the degree of correlation, is $R = 1 - \frac{6S\ (D^2)}{N\ (n^2-1)}$. The computations showed the r of the two methods for house samples to be .99, for figure in action to be .95, for rabbit samples to be .98, and for tree samples to be .96.

TABLE VIe

SHOWING COMPARISON OF SERIAL AND 'LEGEND DISTRIBUTION' OF HOUSE SAMPLES

Samples	Serial dist. per cent rank array	Legend dist.	Differences in rank +	Differences in rank −	D o	S(D²)
A60	1	1			0	0
B1	2	2			0	0
A17	3	3			0	0
B131	4	4			0	0
B162	5	5			0	0
D59	6	6			0	0
D64	7	7			0	0
H89	8	8			0	0
G92	9	9			0	0
K53	10	11	1			1
H69	11	10		1		1
H120	12	13	1			1
J62	13	14	1			1
H106	14	12		2		4
J59	15	17	2			4
K46	16	15		1		1
J3	17	16		1		1
J109	18	18		0		0
K75	19	19		0		0
K89	20	20		0		0
L200	21	21		0		0
Totals ..			5	−5		14

$$p = 1 - \frac{6 \times 14}{9240} = .99, \text{ whence } r = .99$$

In the serial distribution it was found that the position of the medians in array did not in all instances conform with that of the per cent rank. This occurred in two samples in Table VId. The array of per cent rank is allowed to prevail, since it forms the basis of the final array of the samples in the scale.

IV. ARRANGING SAMPLES IN THE SCALE

1. Probable Error Taken as Unit of Measure Between Medians

The rank given a sample by the judges depended of course upon the degree of its qualities in relation to those of all the other samples. It was a rank based upon merit. An inspection of Tables VIa, b, c, and d shows that judgments of merit of a sample tended, with but minor exceptions, to greater frequencies about the median rank, and to grow less and less above and below that point. The effect of such a spread in the distribution of the judgments produced overlapping, so-called, of merit between adjacent and near-adjacent samples in the median array, so that a certain per cent of the judgments of a lower sample might extend beyond one or more medians of higher samples, while still other per cent of judgments of the same sample might reach below the median or medians of lower samples. Advantage is often taken of this form of distribution in scale construction to measure the distance between medians of adjacent samples or groups. To do so implies the necessity of assuming that judgments of merit or of rank conform to a normal surface of distribution and that distances on either side of the median line of such a surface may be measured off on its base line in terms of the median deviation or probable error.

The P. E. thus becomes the unit (perhaps the best available at present) for measuring distances between adjacent medians of groups in serial distribution.

Attention is here directed to those properties of the P. E. that make such applications possible. Fig. VI shows a normal surface of frequency. The line dM is drawn perpendicular to the base of the distribution surface so that 50 per cent of all judgments lie on one side of dM, and 50 per cent on the other side. The point where the perpendicular cuts the base is the median point. The perpendicular line e is so drawn to the right of the median point that just 25 per cent

of the judgments lie between it and the median *dM*. A similar perpendicular *cb* is drawn to the left of the median. The area *cbef*, cut off by these perpendiculars, contains the middle 50 per cent of all judgments. The distance *bM* or *fM* on the base line *xy* is the Probable Error; i. e., a distance along the base line of a normal frequency surface from the median point to the perpendicular on either side of the median which cuts off 25 per cent of the cases, is P. E. It has also

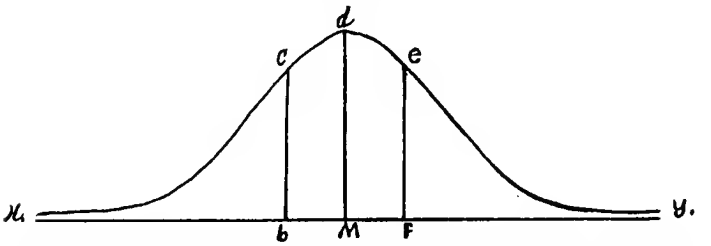


FIG. VI.—Normal surface of distribution showing the Median and P. E. distance at each side of the Median Point.

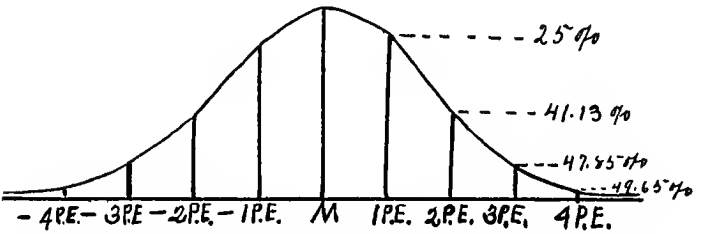


FIG. VII.—Normal surface of frequency showing P. E. distances from the Median Point.

been found that if a perpendicular be erected at a distance of two P. E. on the base line of the surface of frequency, and on either side of the median point, it will include with the median perpendicular 41.13 per cent of all the judgments; if erected at a distance of three P. E. it will include 47.85 per cent of the judgments; and if erected at a distance of four P. E. it will include 49.65 per cent of the judgments. Fig. VII shows the conditions in a graphic way. In the present investigation P. E. values above 3.6 were not needed.

But since units of P. E. represent so many per cent of 50 per cent of judgments it follows that, if the per cent of judgments above or below the median be known, the corresponding P. E. distances can be determined. Let it be required to compute the distance between the median d^1m^1 and $d^{11}m^{11}$ on the base line xy in Fig. VIII, assuming of course that the per cents at which the two frequency surfaces mutually overlap are known. The area included by the lines $sm^{11}n$ bounded by the dotted lines is 15.48 per cent of the area included within the lines d^1m^1n. Whence the per cent included within the area $d^1m^1m^{11}s$ is $50-15.48$, or 34.52 per cent. The P. E. equivalent of 34.52 per cent is 1.507. Also the area included by the lines rm^1p of the frequency surface bounded by the continuous lines is 84.25 per cent of the entire frequency surface, since the per cent included within the area $d^{11}m^{11}rm^1$ is $84.25-50$, or 34.25 per cent. The P. E. equivalent of 34.25 per cent is 1.490. Two measures, then, have been found for the distances m^1m^{11} on the base line xy. The average $\frac{1.507+1.490}{2}$, or 1.4985 P. E., is nearer the exact measure. To apply these processes of computation to determining the distances between the median judgments of each of the 21 samples it was only necessary to arrange the medians in an array, together with the frequency distribution of each sample. These are shown in Tables VIa, b, c, and d, also the per cents of the frequencies within a distribution. Table VII was derived from basic Table VIa. To aid in interpreting the directions for reading these tables, a computation of one distance is here inserted. Let it be required to determine the distance in P. E. units between the median 6.66 of sample *D64* and median 7.67 of sample *H89* of Table VIa. Observe that four (arrived at by interpolation) of the 14 judgments of samples *D64* were equal to or beyond the median 7.67 of sample *H89*. That is, 28.57 per cent of the judgments regarded sample *D64* equal to or better than median judgment of sample *H89*. Hence, 50 per cent minus 28.57 per cent, or 21.43 per cent, makes the upper extension of sample *D64* value—judgments that coin-

TABLE VII

SHOWING AMOUNT AND PERCENTAGE OF OVER-LAPPING WITH P. E. EQUIVALENTS IN THE JUDGMENTS OF SAMPLES

			A60	B1	A17	B131	B162	D59	D64	H89	G92	K53	H69	H120	J62	H106	J59	K46	J3	J109	K75	K89	L200
1	A60	NO.																					
		%																					
		P.E.																					
2	B1	NO.			2																		
		%			14.28																		
		P.E.			1.5834																		
3	A17	NO.		12		1																	
		%		85.72		2.14																	
		P.E.		1.5834		2.1726																	
4	B131	NO.			0		3																
		%			0		21.43																
		P.E.			—		1.1742																
5	B162	NO.				13		4															
		%				92.86		28.57															
		P.E.				2.1715		.8392															
6	D59	NO.					11		2														
		%					78.57		14.28														
		P.E.					1.1742		1.5834														
7	D64	NO.						12		4													
		%						85.72		28.57													
		P.E.						1.5834		.8392													
8	H89	NO.							13		3												
		%							92.85		21.43												
		P.E.							2.1715		1.1742												
9	G92	NO.								11		4											
		%								78.57		28.57											
		P.E.								1.1742		.8392											
10	K53	NO.									11		0.0										
		%									78.57		—										
		P.E.									1.1742		—										
11	H69	NO.										12		6									
		%										85.72		42.85									
		P.E.										1.583		.2670									
12	H120	NO.											0.0		0.0								
		%											—		—								
		P.E.											—		—								
13	J62	NO.												13		3							
		%												92.85		21.43							
		P.E.												2.1715		.8392							
14	H106	NO.													0.0		5						
		%													—		35.72						
		P.E.													—		.5412						
15	J59	NO.														8		4					
		%														57.14		28.67					
		P.E.														.2666		.8392					
16	K46	NO.															11		4				
		%															78.57		28.57				
		P.E.															1.1742		.8392				
17	J3	NO.																8		1			
		%																57.14		7.14			
		P.E.																.2666		2.1726			
18	J109	NO.																	12		2		
		%																	85.72		14.28		
		P.E.																	1.5834		1.5834		
19	K75	NO.																		11		1	
		%																		78.57		7.14	
		P.E.																		1.1742		2.1726	
20	K89	NO.																			0		2
		%																			—		14.28
		P.E.																			—		1.5834
21	L200	NO.																				12	
		%																				85.72	
		P.E.																				1.583	

Table to be read: 2 judgments of Sample B1 extended beyond the median of Sample A17 but two is 14.28% of 14. The P. E. value of difference between 50 per cent and per cent (14.28%) of overlapping is 1.5834. 12 or 85.72% of 14 judgments were above the median (Table VIa) of Sample B1, the P. E. equivalent of difference between 50% and 85.72 is 1.5834. Whence P. E. value or distance between medians of Samples B1 and A17 is $\frac{1.5834 + 1.5834}{2} = 1.5834$.

cide with median judgments of sample *H89*. The P. E. equivalent of 21.43 per cent is .8392. Moreover, one judgment in sample *H89* distribution extends to or below the median 6.66 of *D64*. Hence, 13−7, or 92.85 per cent minus 50 per cent, or 42.85 per cent, equals the distribution of judgments in the

TABLE VIII

SHOWING P. E. EQUIVALENT OF DIFFERENCE BETWEEN 50 PER CENT AND PER CENT OF OVERLAPPING JUDGMENTS FOR ADJACENT SAMPLES: HOUSE

		P.E. Values Upper	P.E. Values Lower	Average P.E. Differences between Medians of Adjacent Samples	Distance in P.E. above Zero Point	Scale Values.
1	A60					0
2	B1				1.0000	1
3	A17	1.5834	1.5834	1.5834	2.5834	3
4	B131	0.0000	2.1726	2.1726	4.7560	5
5	B162	2.1715	1.1742	1.6748	6.4308	6
6	D59	1.1742	0.8392	1.0067	7.4375	7
7	D64	1.5834	1.5834	1.5834	9.0209	9
8	H89	2.1715	0.8392	1.5053	10.5272	10
9	G92	1.1742	1.1742	1.1742	11.7014	12
10	K53	1.1742	0.8392	1.0067	12.7081	13
11	H69	1.5834	0.0000	1.5834	14.2915	14
12	H120	0.0000	0.2670	0.2670	14.5585	15
13	J62	2.1715	0.0000	2.1715	16.7300	16
14	H106	0.0000	0.8392	0.8392	17.5692	17
15	J59	0.2666	0.5412	0.4039	17.9731	18
16	K46	1.1742	0.8392	1.0067	18.9798	19
17	J3	0.2666	0.8392	0.5529	19.5327	20
18	J109	1.5834	2.1726	1.8778	21.4105	21
19	K75	1.1742	1.5834	1.3786	22.7891	23
20	K89	0.0000	2.1742	2.1725	24.9616	25
21	L200	1.5834	1.5834	1.5834	26.5450	27

This Table is derived from Table VII. Upper P. E. values refer to judgments of higher sample that extended to or below adjacent median of lower sample; lower P. E. values refer to judgments of lower samples that extend to or above adjacent higher median.

minus half of sample *H89*. The P. E. equivalent of 42.85 is 2.1715. The average of .8392+2.1715 is 1.5053, which is the distance in P. E. units between the samples in question. Tables VII and VIII show all the computations for the serial distribution of house samples. The fifth column of Table VIII shows the average of P. E. values of each interval between the medians. The summation of these averages is presented

in the sixth column and shows the distance of each sample above zero, as well as the distance between individual samples.

The distance from the zero sample *A60* to sample *B1* is arbitrarily [1] taken as 1 P. E. The seventh column shows the final scale values obtained by discarding all figures to the right of the decimal. This has produced remarkably uniform scale values for the house samples concerned. The results of this form of distribution appear to back up in every instance those obtained under the control 'legend.' The scale values as computed by the overlapping method for the remaining three themes appear in the eighth column of Tables IXb, c, d. These values, despite the higher correlation between the serial and legend distribution, rest upon a number of minor variations that cast some doubt upon their validity and led us to reject their use on the scale samples. Some of the variations could have been prevented if the conditions causing them had been foreseen in time; e. g., a larger number of judges would doubtless have smoothed out some of the irregularities; others inhere in the nature of the work itself.

A full discussion of all the facts would contribute but little to the scale, but the more serious ones are given in order to make clear the reasons for substituting the per cent method for that of overlapping in scaling the distances between the samples. Table VIb shows that the highest values assigned to sample *C23* does not reach the lowest value given to sample *F57*, the next in the median array. Such a condition prevents the direct use of the overlapping method. An inspection of Tables VIc and d shows that the same conditions occur between the second and third samples of figure in action and

[1] No way has as yet been devised for measuring satisfactorily the actual distance in such cases. There is no general agreement as to the nature of the facts upon which such measurement must be computed. The psychologists might be satisfied with some method that would register the growth and coordinations of the psychophysical processes involved in the transition from infantile scribbling to the first meaningful effort. We have preferred to allow the *intention of meaning* as an observable fact to register the difference; but as that is not a numerical measure of the distance we are forced to make an arbitrary assumption.

of tree. We are persuaded that such conditions are due to an over-elimination in reducing the 63 samples to 21. The differences between the samples at the lower limits of the scale appear to be too great by this method. Only use can show whether or not that is a practical defect.

Figure VIII illustrates the absence of overlapping of medians in the case of the frequency surface *qdt*. Several pairs of medians of serial distribution have zero differences, e. g., rabbit samples, Table VIb, have two pairs of similar medians (*H97—H53* and *H51—I29*); figure in action samples, Table VIc, have two pairs (*L5—J14* and *I58—K3*); and

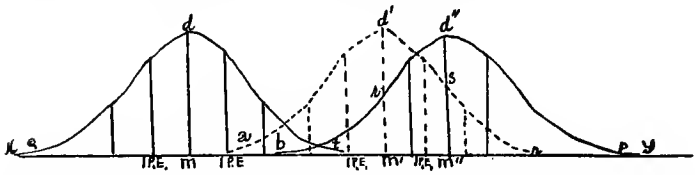


FIG. VIII.—Normal surface of frequencies whose median points are adjacent in array of median values increasing from left to right. No part of surface *qdt* overlaps median of adjacent surfaces. But surfaces *ad'r* and *bd''p* mutually overlap their medians.

tree samples, Table VId, have four pairs of similar medians. Only two samples, Table VIc, show similar ranking by the per cent method.

It is not urged here that the adoption of the per cent method has removed the minor difficulties and inconsistencies encountered in the use of the 'overlapping' judgments, but rather that it obviates the necessity of dealing with them.

The per cent method, like that of overlapping, measures the distance between scale values by means of P. E. units as derived from a normal frequency distribution. Its application in the present instance is based upon the assumption that the achievements in drawings as represented by the values found in the 21 samples are distributed according to a normal frequency surface; that the samples, owing to the manner of selection, show the range typical of drawing achievements as now done by the entire public school groups. It follows that if drawings of such groups be distributed according to

these values by far the largest number would fall on and near the values occupying the median position between the poorest and the best, and that the number of frequencies would become less and less as distances increase plus and minus from the median value. To return to the 21 samples, if now the per cent rank of each of the 21 be ascertained and the respective distances above and below the 50 per cent rank be known it is possible to determine in P. E. units the distance from the median or 50 per cent and from these values one may construct in turn a scale in linear projection beginning with zero value. The arithmetical computation is simple enough; the base upon which the per cents are reckoned is the number of assignable positions times the number of judges; for example, in case of house samples the base is 21 times 14, or 294. The absolute rank of a sample is the sum of the products of the respective serial numbers times the judgment frequencies. The per cent rank then of a sample is derived from its base and its absolute rank.

Tables VIa, b, c, and d show these ranks in the last column to the right and from this column Tables IXa, b, c, and d were constructed. A brief description of these tables will indicate the steps involved in determining the final scale values. The fourth column shows the difference between 50 per cent and the per cent of rank of each sample. The value is minus if the rank is less than 50 and plus when it is more. The P. E.[1] equivalent of these plus and minus values is shown in column five. The zero sample in each theme is arbitrarily set 1 P. E. below the P. E. value of the next sample. Thus the P. E. value of *A60*, house sample, Table IXa, is set at minus 3.3195 below the median for the reason that sample *B1* just above has P. E. minus 2.3195.[2] Locating the dis-

[1] P. E. is computed from Table 48 in "Spelling Ability" by B. R. Buckingham, a variation of Table 44, page 198, of Thorndike's "Mental and Social Measurements."

[2] A clear exposition of this method may be found in a monograph by Henry Gustav Hotz, "First Year Algebra Scales," Teachers' College, Columbia University, 1918. See also, "A Scale for Measuring Pupils' Ability to Demonstrate Geometrical Theorems" by J. K. Minnick, School Review, February, 1919.

TABLE IXa

Showing Per Cent of Rank to Total Possible Rank Difference Between 50 Per Cent and Per Cent Rank, P. E. Equivalent of Per Cent: House, 14 Judges

No	Name of Sample	Per Cent Rank of Sample	Difference between 50% and Per Cent Rank of Sample	P.E. Equivalent of difference between 50% and Per Cent Rank of Sample	Distance of P.E. above zero point	Scale Value of Sample
1	A60'			-3.3195	0	0
2	B1'	5.77	-44.23	-2.3195	1.000	10
3	A17'	8.84	-41.16	-2.0030	1.316	13
4	B131'	16.33	-33.67	-1.4542	1.865	18
5	B162'	21.08	-28.92	-1.1920	2.127	21
6	D59'	22.45	-27.55	-1.0736	2.246	22
7	D69'	29.59	-20.41	-.7854	2.534	25
8	H89'	34.35	-15.65	-.5880	2.721	27
9	G92'	35.71	-14.29	-.5426	2.776	28
10	K53'	42.17	-7.83	-.2932	3.026	—/
11	H69'	48.64	-1.36	-.0504	3.269	32
12	H120'	50.34	+0.34	+.0126	3.332	33
13	J62'	62.04	12.04	.4546	3.774	37
14	H106'	63.00	13.00	.4920	3.815	38
15	J59'	66.33	16.33	.6262	3.944	39
16	K46'	72.10	22.10	.8690	4.188	41
17	J3'	74.50	24.50	.9770	4.296	43
18	J109'	80.85	30.95	1.2990	4.618	46
19	K75'	84.01	34.01	1.4756	4.795	48
20	K89'	91.15	41.15	2.0020	5.321	53
21	L200'	93.20	43.20	2.2110	5.530	55

Read the table as follows: 14 judges in serial ranking placed Sample A60 at zero (0), Sample B1 at 5.77% of distance from 0 to 100, Sample A17 was assigned 8.84% of the distance. [294, 14 × 21 is taken as base and the sum of products of number of judgments by their rank is the per cent, e. g., A17 was placed at 1, 3 times, at 2, 10 times, and at 3, 1 time (Table VIIa), giving a total of 26; whence per cent rank = 26 × 100 ÷ 294 = 8.84%.] Sample A60 is arbitrarily assigned per cent rank — 48.75 giving P. E. — 3.3195 approximately. Sample B1 then becomes 1 P. E. Final scale values are obtained by moving the decimal point in column VI one place to the right. 1 sample does not appear in the scale.

TABLE IXb

Showing Per Cent of Rank to Total Possible Rank, Difference Between 50 Per Cent and Per Cent Rank, P. E. Equivalent of Per Cent: Rabbit, 12 Judges

No.	Name of Sample	Per Cent Rank of Sample	Difference between 50% and Per cent Rank of Sample	P.E. Equivalent of Difference between 50% and Per cent Rank of Sample	Distance of P.E. above zero point.	Scale Value of Sample	Scale Values by overlapping method.
1	B27*	0.79	-49.21	-3.597	0	0	0
2	C23*	3.96	-46.04	-2.597	1.000	10	1
3	E57*	11.11	-38.89	-1.810	1.787	18	2
4	E73*	16.27	-33.73	-1.458	2.139	21	3
5	E63*	21.42	-28.58	-1.175	2.418	24	4
6	D57*	24.20	-25.80	-1.038	2.559	25	4.6
7	E60*	27.38	-22.62	-.892	2.705	27	5.4
8	E49*	34.52	-15.48	-.591	3.006	30	7
9	D63*	40.07	-9.93	-.373	3.224	32	9
10	H97*	42.46	-7.54	-.282	3.315	33	10
11	H63*	49.04	-5.96	-.222	3.375	—+	—
12	H60*	54.36	+8.36	+.162	3.759	37	12
13	J49*	58.73	8.73	.327	3.924	39	13
14	J97*	62.62	12.62	.477	4.074	40	14
15	H45*	68.85	18.85	.729	4.326	—	—
16	H51*	72.22	22.22	.874	4.471	44	15
17	I29*	71.03	21.03	.821	4.418	—	—
18	I34*	80.15	30.15	1.256	4.853	48	18
19	I9*	81.34	31.34	1.320	4.917	49	19
20	H109*	90.47	40.47	1.941	5.538	55	21
21	K10*	94.84	44.84	2.417	6.014	60	22

Read as Table IXa.

* The P. E. of Sample B27 is — 3.578 instead of —3.597. The latter value is preferred in order to make 1st step above zero equal 1.

† Samples do not appear in scale. See text.

TABLE IXc

SHOWING PER CENT OF RANK TO TOTAL POSSIBLE RANK, DIFFERENCE BETWEEN 50 PER CENT AND PER CENT RANK, P. E. EQUIVALENT OF DIFFERENCE: FIGURE IN ACTION, 12 JUDGES

No	Name of Sample	Per Cent Rank of Sample	Difference between 50 and Per Cent Rank of Sample	P.E. Equivalent of Difference between 50 and Per Cent Rank of Sample	Distance of P.E. above zero Point	Scale Value of Sample	Scale Values by Overlapping Method
1	A5³			-3.474*	.0	0	0
2	B69³	4.76	-45.24	-2.474	1.000	10	1
3	B86³	12.70	-37.30	-1.692	1.782	18	2
4	D42³	14.68	-35.32	-1.557	1.917	19	3
5	C119³	22.61	-27.39	-1.114	2.360	24	4
6	E79³	27.38	-22.62	-.891	2.583	—†	—
7	D98³	34.12	-15.88	-.607	2.867	28	6
8	C150³	34.12	-15.88	-.607	2.867	—	—
9	B115³	35.31	-14.69	-.558	2.916	29	5.6
10	C93³	39.28	-10.72	-.404	3.070	30	7
11	D104³	41.66	-8.34	-.312	3.162	32	7.2
12	K37³	52.38	+2.28	+.088	3.562	35	8.8
13	L16³	55.15	5.15	.192	3.666	—	9.2
14	J8³	63.49	13.49	.511	3.985	40	11
15	L5³	71.03	21.03	.821	4.295	42	12
16	J14³	71.82	21.82	.856	4.330	—	12
17	I5³	77.38	27.38	1.114	4.588	45	13
18	I58³	81.74	31.74	1.342	4.816	48	14
19	K3³	82.53	32.53	1.387	4.861	—	14
20	K2³	84.12	34.12	1.482	4.956	50	15
21	J18³	93.65	43.65	2.263	5.737	57	17

* The P. E. — 3.474 is taken arbitrarily.
† Samples do not appear in scale.

TABLE IXd

SHOWING PER CENT OF RANK TO TOTAL POSSIBLE RANK, DIFFERENCE BETWEEN 50 PER CENT AND PER CENT RANK, P. E. EQUIVALENT OF DIFFERENCE: TREE, 14 JUDGES

No	Name of Sample	Per Cent Rank of Sample	Difference between 50 and Per Cent Rank of Sample	P.E. Equivalent of Difference between 50 and Per Cent Rank of Sample	Distance of P.E. above zero Point	Scale Value of Sample	Scale Values by Overlapping method
1	B10			-3.474	0	0	0
2	D22	4.76	-45.24	-2.474	1	10	1
3	E4	11.56	-38.44	-1.775	1.699	16	2
4	E16	15.98	-34.02	-1.476	1.998	19	3
5	C186	17.00	-33.00	-1.415	2.059	20	4
6	G85	29.93	-20.07	-.780	2.694	26	4.8
7	F124	31.63	-18.37	-.768	2.706	27	5
8	H176	37.41	-12.59	-.476	2.999	30	5.2
9	H173	38.09	-11.91	-.449	3.025	—	—
10	E67	45.75	-4.25	-.158	3.316	—	—
11	F178	50.00	0.00	.000	3.474	34	6.7
12	H169	55.10	+5.10	+.190	3.664	36	6.7
13	E61	56.05	6.05	.226	3.700	37	7.5
14	E161	58.16	8.16	.305	3.779	38	7.5
15	G43	68.36	18.36	.708	4.182	41	8.7
16	H5	69.38	19.38	.751	4.225	42	9
17	E91	75.51	25.51	1.024	4.498	44	9
18	I65	76.88	26.88	1.090	4.564	45	8.7
19	F153	80.95	30.95	1.299	4.773	47	10
20	L10	81.97	31.97	1.355	4.829	48	11
21	H180	92.17	42.17	2.100	5.574	55	12

* Samples G43 and I65 have same medians, but are separated here owing to difference in per cent rank.
† The distance above zero by 'overlapping' method is relatively small owing to the many similar medians from serial distribution.

tances of the remaining samples consisted in subtracting the minus P. E. values from that of zero sample and in adding the respective P. E. values. The results as shown in column six were converted into final values by moving the decimal one place to the right and counting the decimal to the nearest whole as an integer. These values appear on, and, of course, determine the order of, the samples in the sale.

2. Basis for Futher Elimination of Samples

Although the serial distribution contained 21 samples the number finally assigned to each scale was slightly less in each case. The number stands: house, 20 samples; tree, 19 samples; rabbit, 18 samples; and figure in action, 16 samples. The bases for elimination were in general two: if the ratings on two drawings gave identical medians the less serviceable for the step in question might be dropped; or again, if a sample duplicated the significant features of the two samples on either side and added nothing new on its own account, or was significantly lacking in features better expressed by adjacent samples for that step, it was omitted; or again, if there was a reversal of the median array by the per cent rank such a condition was regarded as ground for rejecting one or both samples. Tables IXc, sample *D98*, and Table IXd, sample *I65*, show one reversal each. But if such a sample added some significant feature and was backed up by the legend distribution it might be retained; this applies to the tree sample *I65*.

From the house series samples *K53*, serial score 9.4, scale value 30, was omitted because it failed to express proportion of parts and ability for handling typical drawing principles for this section of the scale, better expressed by adjacent and other samples.

From the rabbit series three samples were omitted: *H63*, serial median 9.5, because its median was identical with that of *H97*, and unlike the latter it failed to express proportion and due relation of parts typical at that step of the scale. All the pertinent characteristics of *H45* were duplicated by

J47. The serial and 'legend medians' of *I29* duplicated both of those of *H51*.

From the figure in action series five samples were dropped for the reason that their places were equally represented by an adjacent sample either above or below. Their presence contributed no new feature to the scale. An inspection of Table VIc shows that some of these duplicated the medians of adjacent samples and one sample, *C150*, has the same per cent rank as an adjacent sample, but lacked features characteristic of this section of the scale. Only two samples were dropped from the tree series, despite the fact of many duplicate medians. The per cent rank of the trees presents no duplications, and besides the samples having similar medians are all different species of tree and on that account, while not adding anything decidedly significant to the scale, show a different sort of achievement.

Before leaving this section of the scale attention is directed to the fact that each sample won its place, as it were, by a series of competitive tests, the conditions of which it will be observed were kept objective as far as possible. In general, three methods have been applied: (1) A rough 'type-median-75 per cent-agreement' plan. (2) Use of the legend in controlling distribution of 63 samples. (3) The serial plan. The statistical pedigree of any sample may be traced by inspecting in succession the following tables: IV, VI, and IX. Figure IX shows a comparative view of linear projections of the scales of each of the four themes. The linear projections of house and rabbit scales show more uniform distances between scale units.

3. Analytical Description of the Samples

The description of the samples is pedagogical in its aims, intended to aid teachers and pupils in the use of the scales.

The descriptive matter appears under the scale pictures to be found at the end of the study.

This function of scales is sometimes questioned and, perhaps, properly so for some scales, but no sufficient reason appears for limiting drawing scales to merely measuring results.

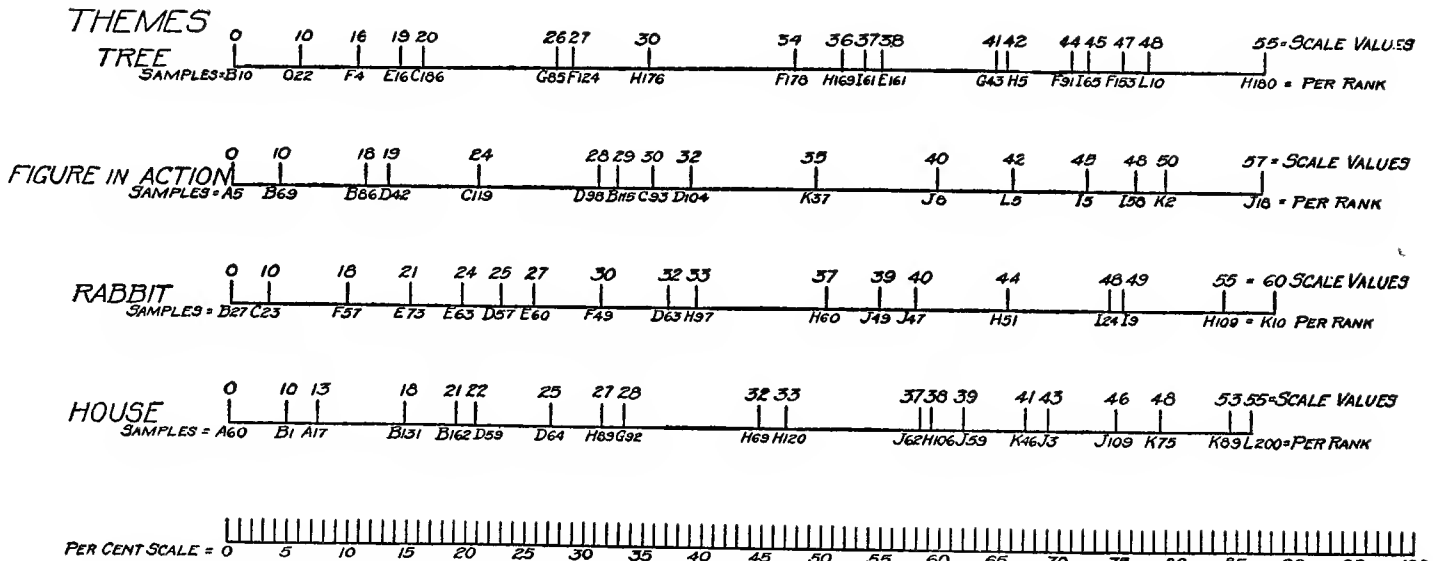


FIG. IX.—Showing line projection of per cent rank of samples and corresponding scale values as based upon P. E. Equivalents. [Per cent rank values given in Table IX.] Note: Samples of different themes having same scale value but different rank in per cent will not occupy similar points in linear projection.

4. Directions for Using Scale

A. DIRECTIONS TO PUPILS

Turn to the theme on the scale folder that is similar to your drawing. Move your drawing along the scale until a sample is found that appears to match it. Read the description of the sample given below and see if it describes your own drawing as well. If the description does not apply so well to your drawing, read that of the sample next below in the scale and also compare your drawing with the scale samples. Now, if your drawing matches the sample and fits the description, write on your drawing the number in the scale. But, if the second sample and its description is not so good as the first, go to the sample and description that is just above the first that you used, and make a similar comparison and if this is more satisfactory than either of the other two, give to your drawing the score similar to the number on the sample. This number is the score of your drawing.

If you wish to get your standing for drawing in representation, as it is called, make four drawings from memory; a house or any other kind of building, a rabbit or squirrel, a tree, and a boy running. Then grade each according to the directions given above and find the average of the four grades. The average scale value that is nearest is your standing in drawing as measured by the scale.

B. DIRECTIONS TO TEACHERS

To score a drawing compare it at least with three drawings of the scale in the manner of the directions given to the pupils. To ascertain the standing of a class: (1) Classify the drawings according to themes. (2) Place the scale folder on blackboard molding or other support. (3) Score all drawings of the same theme before passing to those of another and record the scores in the blank space provided in the score sheet as given in the text. (4) Compute the median and average for each theme separately. (5) Average the medians for the different themes thus scored. The scale

numbers nearest to the average of the medians is the class standing for drawings done in representation.

A form of the score sheet is given here, and in it are shown the scores of 20 drawings of houses done by the 7th grade and 20 drawings of trees done by the 5th grade. The median score for the house drawings of the class is 26, which is nearest to scale value 25 written on sample *D64*. This scale sample thus becomes the measure of the 7th grade drawings of houses. The median score of the 5th grade drawings of trees is 20, which is the same as the scale value of sample *C186*. This sample then becomes the measure for the tree drawings of the 5th grade. The same drawings were scored to the scale by two other judges. The scores of the three judges are given here.

	House		Tree	
Judges	Average	Median	Average	Median
1	27	26.5	21	20.5
2	28.75	28.00	29	28
3	28	27	27.50	27

5. Desirability of Standardizing the Scale

"To the teacher of artistic temperament who objects that accurate grading of work in drawing is impossible, that much work is dependent upon sentiment, is intangible, and should be left unmeasured so far as the pupil is concerned, the answer is that measurement in drawing is constantly being made through 'grades' or 'marks' which are given to children." This quotation from Wilson and Hoke "How to Measure," written in the interest of measuring school art according to scales applies with equal force to standardizing the achievements of public school drawing. It is doubtless true that we have acquiesced all too long in the notion that the products of drawing were due to more or less mysterious gifts independent of methodical instruction and painstaking effort. When it is once realized that drawing talent, so-called, shares in equality of distribution with the gifts involved in the mastery of the other common branches, and that higher products of art are made possible by the mastery of its funda-

TABLE FOR SCORE SHEETS

Score Sheet for Class in Drawing

teacher's record

Town or City..... School.....

Grade..... Date.....

Pupils' names	Score for drawings: House	Rabbit	Figure in action	Tree	Average
1	22	...	...	26	...
2	27	...	...	26	...
3	22	...	...	20	...
4	27	...	...	20	...
5	25	...	...	30	...
6	27	...	...	20	...
7	27	...	...	26	...
8	27	...	...	16	...
9	25	...	...	26	...
10	27	...	...	10	...
11	18	...	...	20	...
12	28	...	...	20	...
13	27	...	...	19	...
14	22	...	...	20	...
15	22	...	...	19	...
16	21	...	...	20	...
17	13	...	...	20	...
18	33	...	...	10	...
19	27	...	...	10	...
20	22	...	...	10	...
Average	24.4	...	...	19.5	...
Median score	..	...	...	..	...
Median of averages	..	...	...	..	...

Score Sheet for Class in Drawing

[Duplicate]

Tear on dotted line and return to authors

Town or City..... School.....

Grade..... Date.....

Pupils' names	Score for drawings: House	Rabbit	Figure in action	Tree	Average
1	22	...	...	26	...
2	27	...	...	26	...
3	22	...	...	20	...
4	27	...	...	20	...
5	25	...	...	30	...
6	27	...	...	20	...
7	27	...	...	26	...
8	27	...	...	19	...
9	25	...	...	26	...
10	27	...	...	10	...
11	18	...	...	20	...
12	28	...	...	20	...
13	27	...	...	19	...
14	22	...	...	20	...
15	22	...	...	19	...
16	21	...	...	20	...
17	13	...	...	20	...
18	33	...	...	10	...
19	27	...	...	10	...
20	22	...	...	10	...
Average	24.4	...	...	19.5	...
Median score	25	...	...	26	...
Median of averages	..	...	...	..	...

Send drawings with scores to—
L. W. Kline, Saratoga Springs, N. Y.,
or to
Gertrude L. Carey, Duluth, Minn.

mental technique and by reducing to habit and to 'graphic language' the fundamental art norms, the desirability of having reliable standards and norms becomes apparent.

Teachers of art in Public and private schools are earnestly asked to co-operate with the authors in this work of standardizing the present scale by forwarding to them drawings done from *memory* in their school rooms. It is highly desirable that teachers use the form of score sheet shown above, and send both their own ratings, and the drawings.

V. GENERAL ASPECTS OF TEACHING DRAWING

Inasmuch as children begin to use drawing to express ideas almost as early as the spoken language, we are justified in assuming that the native equipment for drawing is at least equal to that for any other subject, and that approximately the same progress can be expected in drawing as in other subjects under similar instruction.

Imitation is strong in childhood and continues through adult life. During the first few years of the child's life, practically everything is secured through imitation. Some educators object to imitation when it comes to drawing, on the ground that it interferes with free expression. On the other hand, should it not be an aid to free expression by putting the tools in the hands of the child?

In too many schools the child's progress is measured by what he can say, disregarding entirely what he is able to tell with his hands. "I can't tell it, but I can show you how it looks and how it is done," is too often the answer to questions put to children, to be disregarded. This ability to show the construction of animals, plants and objects, and to illustrate processes through graphic representation is too valuable an achievement to be ignored and bears a very direct relationship to constructive work. This view is strongly reinforced by the claim of engineers and by teachers of botany, zoology, geology and all technical subjects. In fact, it is the most natural and most accurate means of description, in all subjects where a clear idea of structure and relation of parts is necessary.

Teachers should keep in mind the fact that the house, the rabbit, the boy running, and the tree, are but types, and when teaching these type-forms other forms based upon the principles involved should be studied at the same time, e. g., when working upon the house, children should draw boxes, street cars, milk wagons, trucks, tables, or other objects involving the elementary principles of construction and perspective.

While learning to draw a rabbit, draw a squirrel, a dog, a horse, or other animals, noting differences and likenesses. The cultivation of the ability to compare and evaluate cannot be over-emphasized. It leads to discrimination and discrimination is the basis of appreciation. We wish also to emphasize the point that the representation phase of the scale is to be used largely as it supplements and contributes to design, composition, and color. Representation is not to be interpreted as meaning an exact reproduction of all the facts of form or structure, e. g., the opportune time for drill in the drawing of the house is when the child needs to draw a house in order to tell a story, such as Red Riding Hood going to the house of her grandmother, etc. In many instances, it is impossible for the child to illustrate the stories in which he revels, unless he is able to draw fairly well the figure in action. This furnishes the incentive for drill in the illustration of such themes as The Boston Tea Party, Horatius at the Bridge, etc. The drill phase should never be emphasized at the expense of expression.

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